ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 14, No. 12. WEEKLY.

NEW YORK, SATURDAY, MAY 18, 1889.

$3 per annum. Single Copies, 10 Cents.

Copyright, 1889, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

The Widdifield and Bowman Electric Car Brake.

The difficulty of stopping long freight trains without dangerous shocks to the rear cars, when in case of emergency a sudden application of the brakes is necessary, has long been recognized, and investigating committees have decided that to overcome this trouble immediate and instantaneous application of the brake power to all cars is required, and that the release should be the same. By the use of electrical energy Widdifield and Bowman claim to have met these requirements, and through their invention, by a simple mechanical device, requiring but a small force of electrical energy and that but for an instant, claim to be able to obtain immediate and instantaneous application of all brakes on the longest trains.

The essential features of the brake consist of a composite sleeve, *c* (see figure) cast on a pair of car axles. (This sleeve is Babbitt metal, with paper disks imbedded in it.) A small pulley, a large pulley and three levers convey to the brake arm several hundred fold more power than is developed by the electric motive force gotten through the brake magnets.

In operating, assuming the electric brakes are in their normal condition, the train being in motion and that it is desired to stop or slacken the speed, the engineer closes the circuit by a switch in the cab, the core *K* and its rack are attracted upward and the rack held wherever placed by a pawl. Only an instant is required to do this, and is all the electrical energy required. This operates a small spring lever which presses the small pulley against the collar *c*, rotating from the periphery of the car axle. This winds upon the shaft the small chain, shown in the accompanying illustration, which in turn, by the action of an intermediate lever *w*, presses the large pulley against the collar *c* with greatly increased power. The pulley revolves and with it the shaft *f*, winding up the brake lever chain and applying the brakes. The brakes being applied evenly and simultaneously to all cars, the train is stopped or speed slackened without shock or jar. To release the brakes the engineer closes a secondary circuit attracting the core of the second magnet, which trips the ratchet and allows the core *k* to drop, releasing the brakes immediately. In case of the train parting, the brakes are set automatically, auxiliary magnets being brought into use for this purpose. The electrical connections between the engine and train and from car to car have been carefully studied and suitable couplings devised. The electrical appliances in the cab are duplicated in the rear car, the conductor thus having the same control over the train as the engineer. This, at a glance, is seen to be another advantageous feature.

The system has been practically tested on the Lehigh Valley road. All sorts of stops were made, brakes being applied both from the engine and from the rear car, also from the top of a car, and the freedom from shocks was very noticeable.

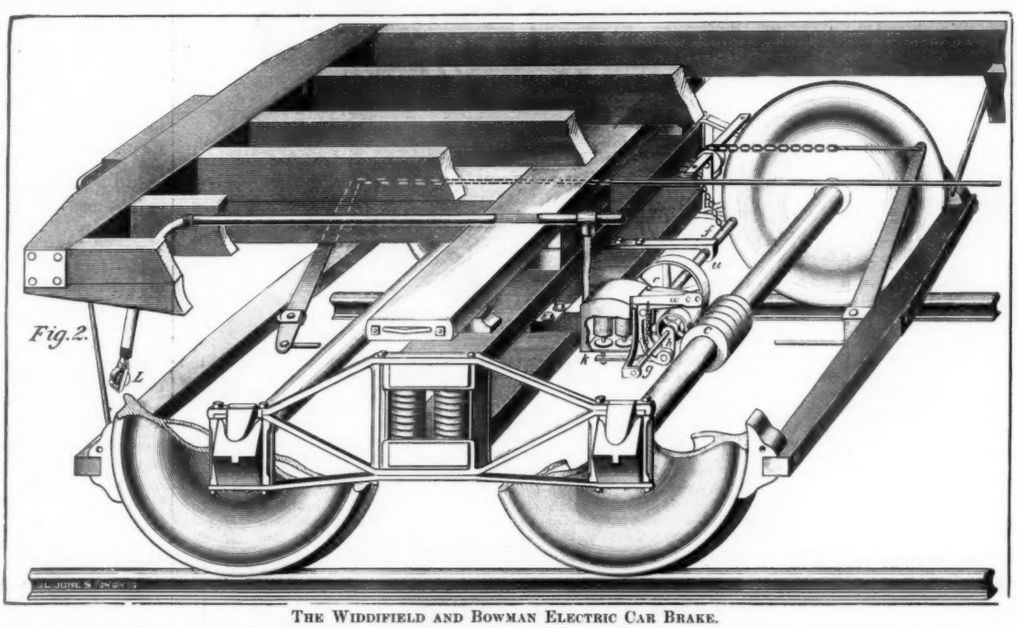


Fig. 2.

THE WIDDIFIELD AND BOWMAN ELECTRIC CAR BRAKE.

A Bell Telephone Victory at St. Louis.

The first case involving the validity of the contracts between the Bell Telephone Company and its subscribers made pending the late test case in the Supreme Court was disposed of before Judge Valliant last week and judgment given in favor of the Bell Telephone Company of St. Louis. The circumstances of the case are that the Municipal Assembly fixed the telephone rates at $50 per annum, which was $50 less than the rates fixed by the company. The company declined to recognize the ordinance, and when its officers were arrested for violating its provisions they appealed to the Supreme Court. A contract, however, was entered into with such subscribers as desired to retain their telephones, to the effect that if the Supreme Court declared the ordinance fixing the $50 rate invalid the subscribers would pay the old rate of $100 per annum, otherwise the company was to charge only $50. Among the subscribers who signed the contract was Mr. M. W. Doyle. He, however, afterwards repudiated the arrangement, and the company sued him for $25, the amount alleged to be due for one quarter. The trial came up before Judge Valliant, J. Hugo Grimm appearing for the Telephone Company, and B. F. Clark for Doyle. The case had not progressed far when the Judge gave an instruction directing the jury to return a verdict for the plaintiff on the ground that the contract between the company and Doyle was valid, and that the Supreme Court having held the ordinance fixing the rate at $50 invalid Mr. Doyle was liable for the $100 rate.

The fire department of Montgomery, Ala., is considering the matter of purchasing an electric fire alarm system for the city.

The Railway Telegraphers.

THE ANNUAL MEETING AND ELECTION OF OFFICERS.

The annual meeting of the Order of Railway Telegraphers, was held last Friday at Toledo, Ohio. The principal business on hand was the election of officers for the ensuing year, and the selection of delegates to the Grand Convention, to be held at Cleveland, June 10. The election resulted in the choice of the following named officers: A. W. Meader, past chief telegrapher; J. C. Harriman, chief telegrapher; G. J. Wirth, assistant chief telegrapher; H. W. Ellinghouse, secretary and treasurer; S. A. Stalcup, senior telegrapher; J. R. Craun, junior telegrapher; C. J. Hickox, inside sentinel; E. S. High, outside sentinel. Delegates, J. D. Harmon and A. W. Meader. The order is in a flourishing condition, despite the many obstacles encountered. This fact speaks much for the determination of the operators who are members of the order. The object of the organization is to better the condition of the operators financially, socially and morally. The order now will try to induce railway managers to use the intelligence bureau, and apply to it when in need of operators to fill vacancies. As the prejudice of the managers against the order is diminishing, it is expected that this feature will work successfully.

---

* * The machinery recently advertised for sale at the Eddy Electric Manufacturing Company's works, at Windsor, is the property of the Spencer Arms Company, and has simply been stored in the basement. The Eddy Company is constantly buying additional machinery, but has none to sell.

The Root Electric Gas Lighter.

While the match was in itself a great invention the world is trying to-day to do away with the little pestiferous nuisance, and human ingenuity has been considerably

THE ROOT ELECTRIC GAS LIGHTER.

exercised to that end in the way of fire producing methods—lighting apparatus if you please.

One of the most useful of these appliances is found in electrical combination by which the gas is lighted by the mere pulling of a pendant or pushing a button. These are all very well for the owner of expensive premises, but there has long been a demand for a form of gas lighter which the tenant might own—a portable affair which would go with him when he changed residence.

Such an apparatus is the Root Electric Gas Lighter, which the REVIEW illustrates to-day. It is a Chicago invention, and has been on the market for some months there, working successfully and satisfactorily in every instance. It is the invention of Mr. Frank H. Root of that city, to whom several quite broad and valuable patents have been granted.

Each separate lighter in the Root system is individualized at the burner, carrying all the necessary apparatus, battery, coil, etc., within itself. The advantage of this must be apparent. There is no long stretch of wire from the cellar or garret to be fished out in case of derangement, and no opportunity for the line to be either short-circuited or grounded. Each being independent of all other fixtures, these may be changed about to suit the purchaser's whim or necessity, and in case of an accident to one—a thing very unlikely to happen—it is only necessary to exchange with another fixture as readily as you would exchange any two burners of the plain, ordinary variety. In fine, it is an efficient, reliable, economical apparatus, which saves property from injury incident to the use of matches, and decreases fire dangers.

The Standard Electric Company's Arc and Incandescent Apparatus.

The apparatus herewith illustrated is that of the Standard Electric Company, of Vermont, of which Col. Franklin Fairbanks is president; Edwin R. Whitney, vice-president; P. F. Hazen, secretary, all of St. Johnsbury, Vt., and William P. Fairbanks, treasurer; W. S. Hill, chief of executive committee; L. A Milbank, manager, of Boston. The manufacturing of the company is carried on at the scale works of E. & T. Fairbanks & Co., at St. Johnsbury, Vt., shown in the first illustration.

The Standard Company has acquired control of the patents issued to Charles S. Bradley, of Yonkers, N. Y., and to Herman Muller, of Zurich, Switzerland, which cover certain improvements in the construction of dynamo electric generators, by means of which the electric current to light a given number of lamps can be produced, it is claimed, with a saving of more than one-half in net weight and one-third in revolutions, consequently a large saving in power.

The principal feature of the Bradley dynamo lies in the methods of applying the copper conductors to the armature, by means of which all the electrical features of a perfect closed circuit armature, which is substantially a Gramme Ring, are obtained, and the armature is enabled to run in a multipolar field and to deliver a direct and continuous current from a single pair of brushes, the same as is obtained from an ordinary two-poled dynamo used for incandescent lighting. The electro-motive force generated is determined by the strength of the magnetic field through which the conductor or the armature passes, and by the rapidity with which the inductive impulses succeed each other; hence by the use of a larger number of field magnets, so arranged that the effect of each is cumulative upon that of the one preceding it, a given amount of electro-motive force may be generated with much less speed of rotation of the armature.

The accompanying illustration, Fig. 2, shows very clearly the main points in the construction of the incandescent dynamo. It weighs a little over half a ton and has a capacity of 300 16 c. p. lamps, with a speed of 900 revolutions for 100 volts or 750 for 75 volts. The iron core of the armature fills all the space embraced by the poles of the field magnets as closely as it can and have room for it to revolve, thereby reducing the resistance of the magnetive circuit to a minimum.

The copper conductors are imbedded in narrow grooves, and are almost entirely surrounded by the intensely magnetized iron of the armature and are thereby subjected to the highest inductive effect while passing under the field magnets. Fig. 3 shows a view of the armature, the inductor bars imbedded in its core. Instead of being covered with cotton, these bars are separated from the iron by a fire-proof insulation made for the purpose. The connectors at the ends of the armature bars are separated by air spaces and require no other insulation, making burning out of the armature practically impossible.

In the magnetic circuit, as will be seen in the illustration, Fig. 4, there are six magnets round the armature, each alternate one being of opposite polarity. The part of the magnetic circuit between the magnet and the armature is shown by the dotted lines *p*. The iron core of the armature F, fills the whole space between the pole pieces and the inductor bars are imbedded in the armature so as to receive the greatest inductive effect from the highly magnetized iron, as they pass in succession under the powerfully-charged field magnets. While a current of electricity can be insulated so that it will not pass from one wire to another, even though they lie closely together, magnetic lines of force will pass freely through all known substances. As the resistance increases with the space or distance traversed, the narrower the space between the iron core of the armature and the field magnets, the less will be the resistance of the magnetic circuit. The fact that this space is filled with copper wire does not reduce the resistance. Scarcely a trace of magnetism is perceptible in any part of the machine, except at the pole pieces directly over the armature.

The efficiency of the apparatus and lamp speaks for itself when the fact is noted that the "Standard" dynamo machine gives 12 lights of 16 candle power each to the horse power at a speed of less than 750 revolutions.

The "Standard" Arc Dynamo, shown in Fig. 5, is the invention of Mr. Warren S. Hill, one of the oldest and most experienced electricians in Boston, and nearly, if not quite, the first man to engage in the electric lighting business in that city. The frame and bed-plate of the dynamo are made of soft iron, cast in one piece. The bearings which support the armature are bolted to the bed-plate giving solidity. The magnets are of soft wrought iron, and are secured to the frame by bolts passing through the magnets and pole pieces. The armature is of the Gramme Ring type. It is constructed in the most thorough manner, and is a superior piece of electrical and mechanical skill. The wire used is of the best quality, double covered with the very best insulating material, and the coils are insulated from each other to prevent the possibility of a short circuit between them. The commutator is made of hardened copper with mica insulation between the bars. The radial arms have grooved screw connections to admit the armature wires, hence no soldering of the connections is required. The brushes are adjustable while the machine is running, and the yoke permits their free movement around the commutator for the purpose of adjustment, and there is practically no sparking at the commutator.

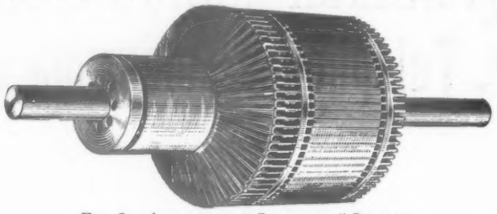


FIG. 3.—ARMATURE, "STANDARD" DYNAMO.

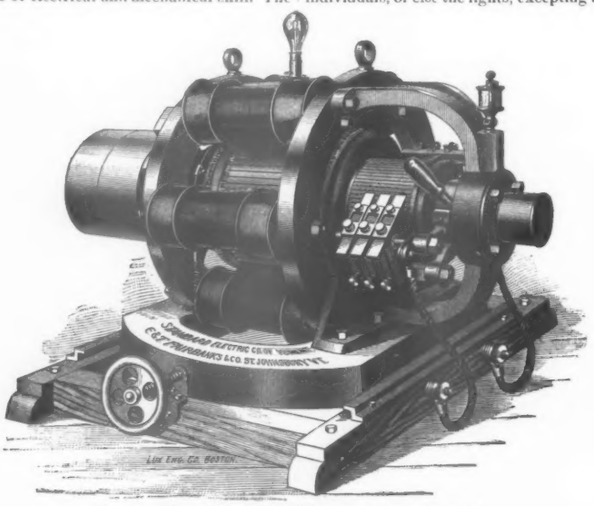


FIG. 2.—THE "STANDARD" INCANDESCENT DYNAMO.

The "Standard" arc lamp, also the invention of Mr. Hill, possesses advantages of simplicity of construction with no small parts to get out of order.

At Fire Headquarters, 67th street, New York, a 300 light machine has furnished current every night, from sunset to sunrise, for 315 100 volt. 16 candle power lamps, for the past nine months, and but one set of brushes has been used. Another "Standard" machine is lighting the New York Life building at 346 Broadway, being in operation during the day.

Municipal Lighting for Somerville

The Somerville (Mass.) *Journal* prints an editorial bringing up arguments against the city's buying and operating its own electric light plant. The following is a clipping:

"Somerville is already supplied with electric lights by the Somerville Electric Light Company, which is backed by Somerville capital, and is composed of Somerville citizens. This company has invested a good deal of money in its plant, and it has been carrying on the business of furnishing electric lights to the city and to private individuals with satisfaction to all concerned. The city is not now paying a high price for the lights furnished by the company, and it is not claimed that any remarkable saving could be made if it were to provide the lights at its own expense. On the other hand, the patronage of the city is essential to the company, and if it were withdrawn the operations of the company would very likely stop. In that case, either the city would have to furnish electric lights for private individuals, or else the lights, excepting those in the streets, would have to be given up. The need and usefulness of the service is evident to everybody, but it does not seem fitting that the city should go into the business of furnishing electric lights to private individuals. That service is better rendered by a company, as at present."

* * The Belding Motor and Manufacturing Co. claim that they have more motors on Edison circuits in Chicago than all other motor companies doing business there.

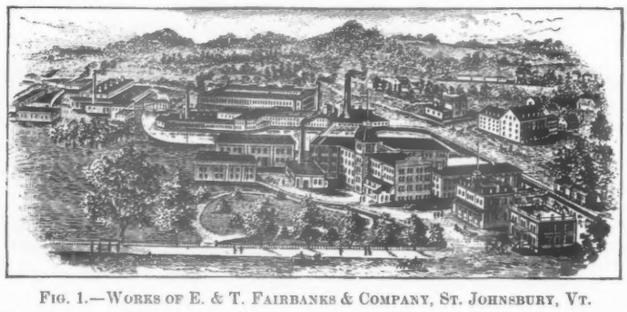


FIG. 1.—WORKS OF E. & T. FAIRBANKS & COMPANY, ST. JOHNSBURY, VT.

—— The Messrs. Leonard & Ellis, who have secured the contract for lighting the streets of Harrison, N. J., with electric lights, have been trying to buy the works of the Callender Insulating Company, it is said, but owing to the complicated state of affairs in which that company is involved, the negotiations have fallen through. The electric light company bought the poles that the Harrison Electric Light Company had erected, and they will begin the stringing of their wires in a few days.

The Limit of Speaking on Telephone Lines.

BY DR. V. WIETLISBACH, OF BERN.

The most important electrical properties of a line are its resistance, capacity, induction, and insulation. A perfectly accurate theory would also have to take into account the polarization of the dielectric employed for insulation and the magnetization of the material of which the lines consist. And further, we have to take into consideration the fact that the very rapidly undulating telephonic currents do not uniformly utilize the whole cross-section of the wire, but chiefly circulate on its surface. Sir W. Thomson has calculated that a current of 150 waves per second only penetrates to a depth of three mm. into the wire, so that the largest useful cross-section would amount to six mm. If we wish to make use of larger cross-sections, we must give to the conductors the form of hollow tubes or flat ribbons, in order to avoid waste of conducting material. Telephonic currents generally are even more rapid, and the useful cross-section is therefore reduced to 4.5 mm. For this reason so-called compound wires have lately been used for long lines, consisting of a copper tube with an iron or steel core.

In addition to these requirements, which can be clearly defined from a technical point of view, numerous other questions have to be considered in telephony, such as the nature and sensitiveness of the apparatus, the greater or less aptitude of the voice and the ear of the persons conversing, so that it is quite impossible to determine in a general and accurate manner the distance to which speaking is possible. In spite of this we find articles published continually which treat of this subject. From a theoretical point of view one can speak to any distance. One has only to bring apparatus and lines in agreement with one another and with the desired distance. Similar conditions prevail here as with the telegraph. If a Morse apparatus has to be worked at a short distance, one single element is sufficient. For longer distances, up to about 100 km., an iron wire of three mm. and a battery of 50 elements are employed. On long direct lines—for instance, Berlin, Rome, Vienna, Constantinople—a wire of 5.6 mm. and several hundred elements, or a powerful dynamo, are used. On long submarine cables these strong currents must not be employed, because they would quickly destroy the insulation. In this case we are restricted to the use of extremely sensitive apparatus, which can be worked securely even with minimum currents. Thus the telegraph adapts itself, by convenient arrangements of line, apparatus and current, to any distance whatever. The longer the distance the more complicated the arrangements, and the more costly the installations; but this is the only reason which forbids the employment of very long lines. On the other hand an installation which is calculated for a line of 100 km. is not fitted to work on a line of 1,000 km.

In like manner we can, by improving the line, and by strengthening the transmitter and the sensitiveness of the receiver, telephone to any distance. The most essential point in this case, too, is the convenient arrangement of the different accessories, which, it cannot be denied, is a more difficult matter than in the case of the telegraph, for the simple reason that a good telephonic transmission requires much greater care in the construction of the line. That the clearness of transmission depends much more on the proper arrangement of the various accessories is proved in the most characteristic manner by the evidence of a New York subscriber, who complains that he has the greatest difficulty possible in understanding another New York subscriber, while he can converse with a Boston subscriber, (a distance of 250 miles) as easily as if he were in the same room.

Mr. Preece has had the unfortunate idea to apply a formula which Sir W. Thomson has given for cable telegraphy to telephone lines, and the formula possessing such weighty credentials has found numerous

successors. The formula in question is

$$t = \frac{130{,}000{,}000}{l^2 K R},$$

where t expresses how many times per minute the word "Paris" can be telegraphed through the cables, l length of the cable, K capacity, and R resistance per km. The correctness of the formula for the purposes and the circumstances under which it was deduced cannot be doubted, but the manner in which it is proposed to use it for telephone lines is an entirely erroneous one. We have at the outset spoken of four electric properties which characterize a line; Thomson's formula only contains two—capacity and resistance. This is easily explained by the fact that Thomson in deducing the formula has telegraph cables exclusively in his view. These are generally insulated with gutta percha; their insulation is, therefore, always the same, and, what is more, relatively very high. The line always consists of copper strands, and the induction is consequently very small. Even under these simple conditions the formula is not absolutely correct, but it suffices for the purpose it has to serve, namely, to calculate in cables of uniform make the most favorable cross-section at a definite speed of transmission.

In cable telegraphy the cable is charged at one end, and then again discharged. By the combination of individual charges and discharges of different length and unequally rapid succession, the cablegram is obtained. In consequence of the great length and the large capacity of the cable the manipulations of the transmitter are not instantaneously transmitted to the other end of the cable, but a certain time elapses between the sending and the receipt of the signals. If now the transmitter is manipulated too quickly, the charging and discharging currents are mixed at the terminal station, and the receiver executes movements which in no way correspond to those of the sending key; so, for instance, a long depression of the key can be changed into a short interval by the discharge current of the previous signal, or a short interval between two depressions of the key into a long one. Thomson's formula determines the rate of speed at which the key ought to be manipulated in order to receive at a given charging capacity of the cable correct signals at the receiving end. Thomson's formula, therefore, refers to G. P. cables, immersed in the sea, traversed by charge and discharge currents, and operated with a syphon recorder, or some such sensitive receiver. And now it is proposed to apply this formula to lines through which currents are circulating which have not the least resemblance with those employed in cable telegraphy, to apply it for the determination of something about which nobody has any clear conception. That this vagueness is not on the side of those who disapprove of the misapplication of the formula is shown by the statements of those authors who have made use of this formula, and which are contained in the following table:

If we write Thomson's formula in the form

$$A = l^2 K R,$$

A has the following maximum values, l being expressed in km., K in microfarads, and R in ohms.

	Preece.	Jacques.	Madsen.	Wietlisbach.	Line, Chicago-New York
Copper overhead	15,000	2000–4500	3000	....	Over 50,000
Cable	12,000	2000–4500	3000	100	Less th'n 5,000
Iron overhead	10,000	2300–4500	6000		

I leave it to the reader to draw his own conclusions from this table.

The product, capacity, into resistance, which is determined by Thomson's formula is certainly a measure of the efficiency of telephone cables. The smaller this product the better the cable for telephonic purposes, and for single wire cables of uniform make the distance of speaking may be approximately determined. But this determination becomes impossible as soon as cables of different make, whose insulating materials are differently affected by polarization, are to be compared with one another, or as soon as the cable no longer forms the sole constituent of the line.

If we consult experience we find that telephoning is possible.

On overhead copper wire to a distance of 2,000 km.
" iron wire " " 300 "
" single wire cables, " " 10 "
" double wire cables not determined.

The latter distance entirely depends on the construction of the cable, and may certainly exceed 100 km.

If on most of the lines these long distances are not reached, the fault rarely lies in the fact that the product of capacity and resistance is too large, but, provided that faulty apparatus are not responsible for it, the insulation of the line is often insufficient, or the insulating material, especially in cables, is not properly chosen, or the magnetic inertia is too large.

From these considerations we may draw the following conclusions:

1. There does not exist at present any formula or rule from which the limit of speaking distance can be calculated even with approximate accuracy.

2. The attempts made hitherto are not decisive, because they rest on a false basis, or were made with faulty apparatus, so that it was not the line but the apparatus which gave out.

3. On overhead copper lines the distance has not been reached yet at which telephoning is impossible.

An Electric Cat Trap.

Mr. C. C. Sibley, a rising young electrician, has conferred a benefaction on humanity by inventing an electric cat teaser. It is designed to lure the nocturnal destroyer of slumber into its deadly embrace while he is under the influence of a delusion that betrays strong men as well as cats to their doom—the delusion that something worth having is to be attained with ease.

The supremely desirable thing to the midnight cat is to get into the adjoining yard, from which he is ordinarily separated by a high fence with ornaments of spikes at the top. Mr. Sibley's apparatus contemplates an inviting hole in the fence down near the ground and just large enough for the cat to crawl through, with what may be expected to be an affectionate squeeze on the part of the fence. Just here is where the cat strikes a snag. There is an electric battery buried at the foot of the fence, and positive and negative poles confront the hole. When the cat is about half way through the hole its whiskers caress one pole of the battery and its tail the other; the circuit is completed, and the animal goes by telegraph to the happy mouse hunting grounds, whence no bone of any traveler returns.

As has been remarked before, there are more ways than one to kill a cat, and the Sibley electric cat trap is the air line to that devoutly wished for consummation.—*New York Press.*

New York's Celebration Heard in Philadelphia Through the Medium of the Telephone.

(From the Philadelphia *Inquirer*.)

It seems almost incredible that a person in Philadelphia should hear a band of music playing in New York City, the ringing of her church bells, the whistles of steamboats, and the shouts of the populace in the streets as the civic and military processions passed by, and yet this was the experience of a lady in this city during the last three days. She takes press news over the long-distance telephone, and, in order to facilitate matters and aid her in hearing distinctly the dictation of the news sender at the other end, she wears a metal cap, attached to which is a receiver that presses close to her left ear. On Monday, during the naval pageant that welcomed the arrival of the President, she distinctly heard the whistles of the steam craft, the roar of the artillery, and the chime of Trinity's bells. On Tuesday, during the progress of the military procession, strains of music from the various bands and the shouts and hurrahs of the witnessing crowds were plainly borne to her ears. These phenomena were repeated yesterday during the passage of the civic parade.

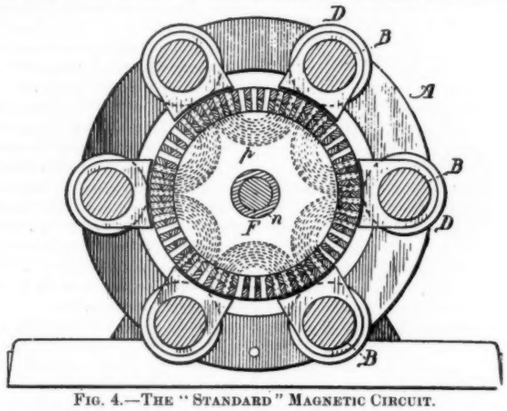


FIG. 4.—THE "STANDARD" MAGNETIC CIRCUIT.

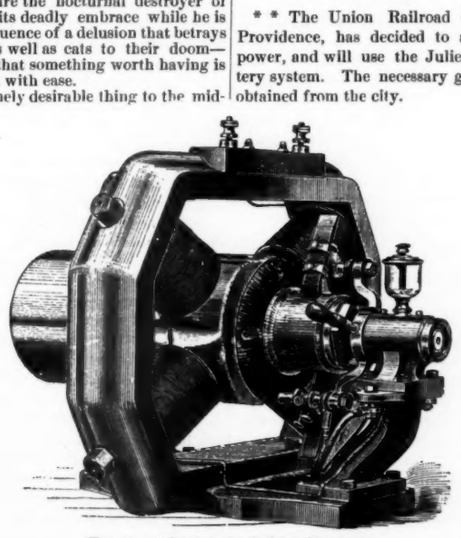


FIG. 5.—"STANDARD" ARC DYNAMO.

* * The Union Railroad Company, of Providence, has decided to adopt electric power, and will use the Julien storage battery system. The necessary grant has been obtained from the city.

* * Wires are being strung in the Square and on Ontario street, Cleveland, by the South Side Street Railroad Company for the electric motor cars. The South Side Company will operate its cars by electric motor power on or before June 1st. The system cost the company $175,000.

* * Judge Barrett, of the Supreme Court, has given authority to Attorney General Charles F. Tabor to bring an action against the Electric Sugar Refining Company to dissolve the corporation, annul its charter and end its existence, and for the appointment of a receiver of the property. The application for leave to bring the suit was based on the petition of the attorney general, accompanied by an affidavit of Lawson N. Fuller, one of the stockholders and trustees of the company.

Toledo, Ohio.—The Union Electric Company, Toledo; capital stock, $100,000.

Milwaukee, Wis.—The Milwaukee Equipment Company; capital stock, $2,000,000. The business of the company is the manufacture of machinery. The incorporators are H. H. Stafford, A. B. Meyers and H. T. West.

Sheboygan, Wis—The Sheboygan Electric Light Company filed articles of association in the Secretary of State's office; capital, $25,000; incorporators, Messrs. A. F. Leberman, W. D. Crocker, M. H. Wilgus and Douglas Gibbs.

Columbus, Ohio.—The Athens Gas Light Company, amendment, enlarging purposes and changing name to the Athens Gas Light and Electric Company; the Columbus Belt and Terminal Railway Company, Columbus, increase of capital stock from $50,000 to $1,000,000.

Wytheville, Va.—A company is being formed with capital, minimum $40,000, maximum $250,000, called the Electric Power and Improvement Company, for the purpose of lighting and furnishing power for the town. J. B. Barrett & Company are the parties interested.

Pittsburgh, Pa.—A charter was filed in the recorder's office for the Pittsburgh Electric Scale Company. The capital stock of the company is $10,000 divided into 100 shares at $100 per share. The directors are M. W. Rankin, John W. Nevin, Charles E. Billon, W. F. Bickel, I. S. Reymer, R. B. Petty and F. G. Paulson.

Chicago, Ill.—Certificates were recently filed in the Secretary of State's office to record the consolidation of the Union Steel Company with the North Chicago Rolling Mill Company, under the name of the Illinois Steel Company, with a capital stock of $25,000,000, for the operation of the works in North Chicago, Hyde Park and Milwaukee.

Carrollton, Ill.—The Litchfield, Carrollton and Western Railway Company; capital stock, $1,000,000; principal office at Carrollton. It is proposed to construct a line from Litchfield to Quincy. The incorporators and first Board of Directors are Ornan Pierson and Daniel Morfoot, of Carrollton; Henry S. Carroll and John O. Roberts, of Clarksville, and William S. Hook and Marcus Hook, of Jacksonville.

Newark, N. J.—The Advance Electric Illuminating Company, of South America, have recorded articles of incorporation in the County Clerk's office. The incorporators are: Theodore Larbig, Brooklyn; Henry S. Morris, New York, and William H. Sewall, of Mount Vernon, N Y. The places of business are Newark, New York, and Loguayra, Venezuela. The company is organized to supply electric light to the city of Loguayra. The office and works of the company are to be kept in Newark; the financial office is to be in New York. The capital stock is $150,000.

* * Over a year ago the Spokane Falls Chronicle Company, of Spokane Falls, Washington Territory, decided to operate their presses by electric power, and purchased a two h. p. Sprague motor for the purpose. Since that time, this motor has been running one Standard Babcock cylinder press and two quarto job presses at the same time. The proprietor of the Chronicle says that during this time it has not cost one cent for repairs, and is just as good as when it was installed, and that the Chronicle Company are satisfied with their electrical power.

ELECTRICAL REVIEW

Published at 13 Park Row
P. O. BOX 3329.

GEO. WORTHINGTON, - Editor.
CHARLES W. PRICE, - Associate Editor.
T. J. McTIGHE, Electrician and Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
TELEPHONE CALL, 546 JOHN.

Timothy W. Sprague, 192 Summer Street, is our representative at Boston, Mass.
Mr. C. C. Haskins, City Hall, Chicago, Ill., represents the REVIEW in the West.
George C. Maynard, 1419 New York Ave., Washington, D. C.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries $5.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, MAY 18, 1889.

CONTENTS.

	PAGE.
The Widdifield and Bowman Electric Car Brake	1
A Bell Telephone Victory at St. Louis	1
The Railway Telegraphers	1
The Root Electric Lighter	1
The Standard Electric Company's Arc and Incandescent Apparatus	2
Municipal Lighting for Somerville	2
The Limit of Speaking on Telephone Lines	2
An Electric Cat Trap	3
New York's Celebration Heard in Philadelphia Through the Medium of the Telephone	3
New Corporations	3
Ocean Telephony	4
A New Method of Treating an Old Problem	4
The Electric Club	4
Latest Electrical News:	
Our Boston Letter	5
Our Chicago Letter	5
Our Washington Letter	5
Personal	5
Telephonic News	6
Annual Meeting of New England Telephone and Telegraph Company	6
The Central Pennsylvania Telephone and Supply Company	7
An Ingenious Call-Bell	7
Swindled by Wire Tappers	7
Telegraphic	7
Electric Power	8
A Compact Plant for Railway Trains	8
The People's Telephone Suit	8
The Spalding Telegraph Company to Begin Work Soon	8
The Chesapeake and Potomac Telephone Company Obtain a Franchise at Baltimore, Md.	8
Telegraph Companies in Litigation	8
More Aluminium Works	9
He Smelled the Electricity	9
Electrolysis by Alternating Currents	9
The R. T. White Rail and Chair	9
Congress of Applied Mechanics at Paris	9
Electric Light News	9
Kindred Interests	10
A Song after Lamplight	10
A Telegraph which Produces a Printed Sheet	10
Gender of the Phonograph	10
Electrical Patents	10

It is stated that an order emanating from the headquarters staff of the French army has just arranged the organization and laid down the duties of the proposed Mounted Telegraph Corps. A telegraph troop, consisting of trained operators, is to be formed in each regiment of cavalry in the French Army. The troopers composing this corps are to go through a special course of field telegraphy for 20 days every year at one of the three centers at Versailles, Lurréville and Lyons; in addition to which they are to be employed on telegraph work when in garrison and on the occasion of the annual manœuvres. In the field every advanced party and reconnoitreing expedition is to be accompanied by portable telegraph apparatus, and the proper complement of operators. The special duty of these telegraphists is to keep up communication with the main body of the cavalry as long as possible, either by heliograph or by means of the existing lines. The telegraphists with the main body have to assist in communicating with those of the advanced detachments and to transmit messages to the general commanding the cavalry division.

The sudden advent of hot summer weather last week brought to many weary business men a realizing sense of the beauties and benefits of electrical energy, as they were refreshed by cool draughts of air from the noiseless fan motors.

At the meeting of the Buffalo Electrical Association, Monday evening, an interesting and timely paper was read by J. P. Chapin. It consisted of a review of the regulations observed in various cities in laying electric wires, and the general management of electric lighting.

Mr. Chas. W. Price, of the ELECTRICAL REVIEW, sailed for the Paris Exposition on the French ship "La Gascogne," last Saturday, and will spend a few months abroad. Mr. T. W. Sprague, of Boston, will take Mr. Price's place on the REVIEW staff, during his absence.

At the meeting of the Royal Meteorological Society, on the 17th ult., a paper "On the Deaths caused by lightning in England and Wales from 1852 to 1880, as recorded in the returns of the Registrar-General," was read by Inspector-General R. Lawson, LL.D. The total number of deaths from lightning during the 29 years amounted to 546, of which 442 were of males and 104 of females. In consequence apparently of their greater exposure the inhabitants of rural districts suffer more from lightning than those of towns. It appears also that vicinity to the west and south coast reduces the chances of injury by lightning, and that distance from the coast and high land seems to increase them.

Hearing and seeing for one's self carry conviction with them, and a short hour or so spent in listening to a lecture, illustrated perhaps by drawings and apparatus, exerts a strong influence on the hearer. The electrical fraternity have been quick to recognize this fact, and the number of short pithy discourses just now on the application of electrical energy for power uses principally, which are being delivered in all parts of the country, shows how the opportunities are being grasped. It is a good thing all around, for the meetings are always well attended, and a better understanding of the subject invariably makes a new convert to the already large army of users and friends of electric power. The management of the Electric Club have wisely taken advantage of the influence exerted by interesting papers practically illustrated, and will do well to continue in the same line in the future.

OCEAN TELEPHONY.

How far it is possible to telephone through an underground conductor, and whether it will ever be possible to talk across the ocean, are questions which are often asked, and to which as yet no one seems to have given a satisfactory answer. In erecting conductors for the transmission of current for light or power, we have carefully prepared tables and formulæ from which the amount and distribution of copper for a given installation can be accurately determined. In a like manner, by the use of Sir William Thomson's formulæ, it is possible to predict the number of words per minute which can be telegraphed through any submarine cable, the dimensions of which are known; or conversely given the number of words per minute which it is desired to transmit, the amount of copper and insulating material necessary for such a result can be foretold. But when it comes to a question of the best dimensions of line for telephone working, the greatest diversity of opinion exists. Starting with the formulæ of Sir William Thomson, which deals with the electro static capacity and resistance of a cable, Dr. Jaques made a large number of observations from which he deduced the empirical law that whenever the product of the capacity in microfarads, and the resistance in ohms exceeded a given sum, that commercial talk would be impossible. Different products were obtained by other observers, including Mr. Preece and Dr. Wietlisbach, whose products give the limit at which speech becomes impossible rather than the point at which it ceases to be commercially successful.

We publish on another page an article by Dr. Wietlisbach amending his views hitherto expressed and attempting to show that the formulæ of all other observers as well as his own are wrong, inasmuch as they fail to take cognizance of all the elements affecting the problem. Leaving our readers to judge of the validity of the specific objections raised by Dr. Wietlisbach, we will state that his general proposition is supported by the experience with long lines in this country.

According to the formulæ of Mr. Preece, as given in another column, it would be impossible to talk over the telephone line between New York and Buffalo, and according to Dr. Jaques commercial talk over such a line would be out of the question, yet a great deal of talking is done over this line and we ourselves have frequently made use of it at an expense of 90 cents a minute, which would seem to indicate that in our case at least the talk was "commercial."

While these conflicting formulæ do not tell us the best way to build a telephone line, it is safe to assume that the distance through which it is possible to telephone either underground or under water is limited by the amount of copper and thickness of insulation employed. To give an idea of the kind of telephone cable which would be required to work under the ocean, it has been calculated that the copper core would have to be about the diameter of a flour barrel and that the insulation would be as large around as a hogshead. To furnish such an enormous mass of copper would consume the entire output of the Calumet and Hecla mine for four years.

A NEW METHOD OF TREATING AN OLD PROBLEM.

The question of overhead wires and the poles to which they are affixed, or (according to the experience during the recent crusade in New York City) one might say, the poles which they hold up, has given rise to other problems than that of the mere peril of the wires.

The great majority of beings have no objection to overhead wires as long as the poles are not in their own way. And such were the sentiments of a citizen in a small city in Massachusetts, who considered the electric light a great benefit in every way. One afternoon, however, the madam saw some men digging in the street in front of the house, and so she asked one of them, who was a practical electrician in his department, namely, that of digging holes for the poles—if he was digging a hole.

"No, ma'am," answered he, with a remarkable precision of speech, "I'm digging the dirt out and laving the hole." And on further inquiry she ascertained that the hole was for a large pole to carry a number of electric light wires.

She at once informed the head of the house (so called) respecting the facts in the case, and he immediately sent out his gardener with instructions to get any kind of a tree at once, and plant it in the hole which the electric light men had dug.

It seems that there is in Massachusetts a very severe law for the protection of trees on the highway, framed, we believe, at about the time the Pilgrim forefathers of blessed memory discovered that a tree was a good thing to hide behind when the Indians were uncivil. It is some time since we have seen the statute forbidding the cutting or mutilation of trees on the highway by any other than the surveyor of the highways or the superintendent of streets, but we believe that the penalty was death for the first offence, and dissection for the second; or it is quite possible that it might not have been quite so severe. Still it was sufficiently harsh to make a man prefer to chop his own fingers rather than the public foliage.

In due time the hole was dug, and the men went away for the pole. Meanwhile, the good householders watched for the coming gardener bearing the tree with all the eagerness of the wife of Bluebeard and her sister gazing for the band of rescuers.

But the men returned with the pole, and when they had laid it down by the roadside, the man of the house appeared and cordially invited them into the cellar to taste some very fine cider, and drink defeat and confusion to the forthcoming vote on the prohibitory clause in the constitutional amendment, to be held in that State on the 22d of April.

By some adversity, as inexplicable as are all accidents which happen on purpose, there was but one glass in the cellar, and therefore it required considerable time for the whole of the party to be treated with the hospitality which the host seemed to think that the occasion warranted. After numerous repetitions, they sauntered out in a refreshed condition, only to find that a tree had already been planted in the hole which they had dug, and as there was no other available place in front of the premises, that it would be necessary for the electric light line to be carried around on a different course, and the obnoxious poles to be placed somewhere else than in front of that particular residence.

The Electric Club.

The new board of managers of the Electric Club, under the active administration of President E. T. Gilliland, is taking hold of the affairs of the Club in an earnest and progressive spirit.

At a meeting of the board held Thursday evening of last week, a number of committees were appointed, and important action taken with reference to the advancement of the Club's interests during the coming year. The gentlemen named below who compose the various committees can all be counted on to do valiant work for the Club.

The next meeting of the Club will be held Thursday evening, May 23, and will undoubtedly be largely attended, and will be the occasion of an interesting address by Mr. Erastus Wiman, which he has entitled, "Electrical Possibilities as Viewed by a Business Man."

The following has been sent out by the secretary of the Club:

"SPECIAL ANNOUNCEMENT."

"The increased income of the Club, resulting from the change in the annual dues, will permit several desired improvements to be made in the Club House.

"The course of lectures which was so successful in the past will be continued. The members may expect this feature of the Club to be particularly valuable and interesting during the present year.

"The Club is continually growing in influence and membership, and starts on its fourth year of existence with a financial strength and growing popularity that assures its success in the future. The Club is well established and may now be classed as one of the substantial institutions of the country—thanks to our progressive electrical fraternity.

"Members of the Club visiting the Paris Exposition will find the Club headquarters open after May 20th, 1889. All mail sent care of the Electric Club, will be held until called for, and all visitors are requested to register their names and their home and Paris addresses."

The committees of the Club as now formed are composed of the following named gentlemen:

House Committee—H. L. Stroke, C. H. Barney, Geo. B. Coggeshall.

Committee on Finance—E. T. Gilliland, O. E. Madden, H. C. Davis, W. T. Moore, H. A. Reed and J. W. Handren.

Committee on Entertainment—Chas. W. Price, J. C. Tomlinson, C. E. Stump, F. H. Wall and Robt. Spice.

Reception Committee—H. C. Adams, Chas. A. Cheever, Amzi Dodd, W. A. Blaney, W. H. Johnstone, J. B. Ecclesine, Jr., Joseph Howard, Jr., Erastus Wiman, C. L. Buckingham, Chas. L. Mitchell and E. M. Hamilton.

Art Committee—E. M. Hamilton.

Electrical Committee—J. P. Chamberlain, J. J. Carty and J. W. Packard.

We find in an old copy of the Freeport *Journal*, Ill., a criticism on Dr. G. P. Hachenberg's lecture on "Musical Telegraphy," delivered in Freeport nearly 20 years ago. The communication is dated August 15th, 1870, and the writer at one place makes the following remarks: "In some things, however, I think he overreached himself, when on this point he said: 'The day is not far distant when the electric powers will be gathered up from over the face of the earth by a network of electric wires, connected in different localities, not only for motor agents, but even to control at will the meteorological influences of the globe.'"

LATEST ELECTRICAL NEWS.

At Boston, Chicago, Washington and Other Points.

OUR BOSTON LETTER.

Overhead Wires.—A bill has been reported to the lower branch of the legislature prohibiting the overhead system of wires for electric roads in cities of 60,000 or more inhabitants. The prejudices of the House may be relied upon to look with little favor on all such plans as this, which are designed more to give an opportunity for certain members to air their eloquence than to promote the best interests of the commonwealth. All attempts to resist the tide of public opinion in favor of electric roads will prove as effectual as the efforts of the gas interests to belittle electric lighting.

The Danvers Electric Light Plant.—The application of Danvers, Mass., to be allowed to furnish incandescent light to its inhabitants has been favorably reported. The gas commissioners are to have supervision of the city plant, and it is to be hoped that the universally unfortunate experience of municipalities in managing commercial enterprises may not be repeated, as is likely to be in the case of the Danvers electric light plant. It is barely possible that the asylum on the hill may have affected or infected the better sense of the voters of the good old town.

Aerial Navigation.—Dr. De Bausset has in preparation a new pamphlet descriptive of his system of aerial navigation. The reports of numerous well-known engineers will be quoted as confirming the claims of the inventor, who now talks of the possibility of completing his air ship in time to carry passengers to the Paris Exposition.

Steel Poles.—The West End Street Railway Company has ordered 5,000 steel poles, for the extensions of the overhead system that it has in contemplation. This number would be sufficient for about 50 miles. The Franklin Park line will be the first changed to the overhead system, and the entire Cambridge division will be operated in a year or more without a single horse. It will be the policy of the company to do its own construction work and generate its own power, while, of course, purchasing all material and electric machinery from the manufacturers of motors and dynamos.

The Ball Electric Light Company, of New England, have sold the Norwalk, Conn., Gas Light Company 140—four ampere—800 candle power arcs. Seventy will be used in lighting the streets of South Norwalk, and the remainder in supplying the demands of the commercial public. It is a significant fact as showing the enterprise displayed by the more progressive gas companies that gas will be depended upon as a motive power, an Otto gas engine having been ordered of sufficient capacity to operate the entire plant. The success at Spencer, Mass., where 62 1 200 c. p. arc lamps are run with a consumption of only 900 cubic feet of gas per hour, proves beyond question the possibilities of economically operating small plants at least by gas engines.

The New England Electric Exchange is daily gaining recognition, and the enlarged powers that will be conferred upon it by a charter now pending in the legislature will unquestionably extend its already large field of usefulness, and make it a still more useful factor, is advancing the well being of all interested in the advancement of electric light and power.

The North Shore Electric Railway Company, of Revere, Mass., are pushing the construction of the road at Revere Beach to connect the piece which was operated last summer from Crescent Beach to the Atlantic House, with a span to the Pier, with the terminus of the West End street railway tracks at Winthrop Junction. For a mile and a half the Boston, Revere Beach and Lynn steam railroad tracks have been parallelled on a bed and trestle independent from the roads or streets, and on this portion a speed of 20 miles will be obtained and a race with the steam road will be given with a five cent ride. Heavy T rails and solid construction will on this part of the road admit of the highest attainable speed.

Chelsea, Mass., was early in the spring a misnomer as regards the old saying of that town, for it was all alive on the subject of a municipal plant. Better counsels prevailed, and at last Mayor Champlin has signed the contract with the gas company for 150 1,200 candle-power arcs, all night, 300 nights in the year, for 30 cents each per night, and 150 25 candle-power incandescents, for $14 per year. F. M. G.

Boston, May 15, 1889.

The projection of telephone and electric tramway companies at Vancouver, B. C., shows the enterprise of that far off land.

OUR CHICAGO LETTER.

The Eiffel Tower.—Now that the huge Eiffel tower of the Parisian engineer is finished, and on exhibition, a certain class of chronic grumblers asks with a grand flourish, "Well, what of it? What is the good of it?" In France as in the United States there is always the funny man on every daily, and he perpetrates very excruciating jokes. He calls the structure a second tower of Babel, there will be so many languages spoken there. He speaks derisively of it, and calls it the carbuncle of the exposition.

De Fonvielle, who has himself the spirit of a bird, and once told me his highest ambition was to be able to fly over Paris—over France—and has done no little in the way of aerial investigation, feels called upon to defend and explain to these would-be wits, some of the few advantages of the monster tower. He says of it, "It is the continuation of the Puy-de-dome expedition when Pascal sent his brother-in-law there with the barometer. Eiffel has supplemented the labors of Pilastre in his cloud expeditions. He has stiffened, extended, metamorphosed the tether of Gifford's captive balloon, as with the wand of an enchanter."

At 273 metres from the earth, the mere curiosity seeker having arrived at the fourth platform is left to gaze and wonder. Above this the elevator does not run, and there is no magic *open sesame* which will admit the mere wonder-monger. The terrace here has a diameter of 16.56 metres, and is completely closed in to protect visitors from the terrible winds which at that elevation, during tempestuous times, sweep unrestricted through cloud land.

Above this an Italian roof protects the doorways to apartments reserved for scientific investigation. In one of these Mr. Eiffel has chosen his study, which is surmounted by four heavy beams interlaced, and four large iron arches, constituting the inner part of the spire proper. A spiral, constructed stairway leads upward to another circular balcony, of 9.0.81 metres elevation, and only 5.5 metres radius. Another stage, 6.67 metres farther—and we are at the foot of the lighting rod, which proudly points to the clouds as a symbol reminding of the great source of light and heat, and magnetism and life. Contrary to statements heretofore made, the tower is not to be entirely lighted by electricity.

The students of meteorology will find in the Eiffel tower opportunities which have never before been vouchsafed to man. Astronomy, the forces of gravitation and attraction, atmospheric resistance and weight, light refractions and reflections, all free from disturbing elements which have hitherto restricted investigation.

The location of the tower is a fitting one. Leverrier, who was the father of the stations of Puy-de-dome and Pic-du-miele, died in the belief that 15 years after his death a grand national observatory would rise on the bank of the Seine. The tower stands like a sentinel guarding the graves of France's great scientific men of the past in Pere-la-chaise and Mont-martre.

The electric generators are placed in the southwest basement of the tower. Six naked copper cables carry the current, these being well fixed on insulators.

The tower is considered as one grand lightning rod, and connections are made direct to the structure, from the rod proper, which surmounts the tower.

Lightning.—The long drought was broken last night by a most beautiful rain storm, one variation of which consisted in a trifle of hail. There was also a goodly supply of thunder and lightning, and several bolts amused themselves by striking too near people to be comfortable. At 5227 Carpenter street, Mrs. Kelly, Mrs. Ferguson and Miss Cummings, two of whom were standing at an open window, and the third by an open door, when lightning struck, rendering the ladies unconscious, but not dangerously wounding either of them. The thermometer dropped its record from 86 yesterday P. M. to 54 this A. M., and the amount of sleeping done last night within the city limits was something as phenomenal as the terribly scalding weather we have enjoyed (?) for the past week.

The Professer.—The *Western Electrician* of to-day publishes a short historical sketch of our city electrician, Prof. J. P. Barrett, with a most excellent portrait of that thoroughly practical gentleman, whose eyes are turned eastward, as if to say to Mayor Grant, "I am with you, my boy. If they want information—if they are in a condition to desire it, I am in a condition to furnish it, you'll understand."

Magnetic Pocketbook.—One of that class of inventions which is to do away with a clasp has recently been invented by B. F. Thomas, of Colorado, and consists of a magnet and a piece of soft iron to hold the flap together. What Mr. Benjamin Franklin needs to do now is to make an application of magnetism to keep the money from getting out when the flap is open, and he can sell two to every small salaried man in the electrical business. C. C. H.

Chicago, May 11, 1889.

OUR WASHINGTON LETTER.

Telephones in the Life Saving Service.—The Life Saving Service is just completing arrangements for the construction of a telephone line along the southern shore of Long Island, from Coney Island to Montauk, to connect the 31 life saving stations on that coast. The work of building the line will be done under the direction of the Bureau's linemen. White cedar poles, 25 feet long, costing $2.15 each, and No. 9 B. W. G. wire, at $4.19 per pound will be used. Eight thousand dollars worth of cables will be required for river crossings, etc.

Superior Line Work.—The Long Distance Telephone Company is setting Maryland line builders an example in the superior construction of the line which it is now putting up between this city and Baltimore. One of the innovations it is making in the customs of this neighborhood, is the bringing of Canada cedar poles into a section of the country which is full of chestnut forests, from which supplies of poles have heretofore been obtained. The company is also building between Baltimore and Philadelphia, and within the next six months this city and New York will be in telephonic communication.

A Farcical Arraignment.—A few days ago a number of telephone linemen were arrested by an officious police officer, without a warrant, for running a short span of wire in an alley. When the men were arraigned in the police court it was discovered that they had violated no law and could not be held. It also appeared that the arrests were made on the request of a disgruntled telephone inventor, whose attempt to break the Bell patents had failed, and now inventor and policeman seem liable to prosecution for false arrests.

To Attend the Conference.—On the 14th inst., President Bryan, with Crenshaw and Crandall, of the C. & P. Telephone Company, are to attend the cable conference in New York, at which the leading subterranean experts will discuss late improvements in the telephone cable business.

An Olfactory Investigation.—The city chemist has decided that there is no danger of explosions in wire conduits here. He arrived at this conclusion after smelling for illuminating gas in a few manholes, and getting a statement from the gas company that their loss of gas by leakage from the pipes amounts to only four per cent. Perhaps the coroner may be the next official to investigate the subject.

Important Proposals.—The Signal office is preparing its annual schedules of miscellaneous electrical supplies, for which proposals will be asked, and will have them ready for distribution to dealers about the 25th inst.

More About the Gramophone.—Mr. Berliner will go to Europe some time in July to exhibit his gramophone to scientific societies and introduce it for practical use. His apparatus has been much improved recently. Not long since Berliner received from a Pittsburgh glass manufacturer a reproduction of one of his gramophone plates, cast in glass, with a letter explaining that on account of some accident the casting was quite imperfect, but that they had gotten Auld Lang Syne out of it quite successfully. As nobody in Pittsburgh had a gramophone, it seemed very astonishing that the glass workers could discover what the faint zig-zag lines on the plate could mean. It is feasible, however, to reproduce the sounds recorded on such a plate by revolving it, by any means, and using a common lead pencil, held between the teeth, as a stylus, and probably some one in the glass factory understood the trick. G. C. M.

Washington, May 9th, 1889.

Recognizing the absorbing interest in electrical matters that is now being universally manifested, Columbia College has formally established a course of electrical engineering.

The course has been placed in charge of Mr. Francis B. Crocker, as "Instructor," and Mr. Michael Pupin has been appointed "Assistant Instructor." Both these gentlemen have admirable credentials. Mr. Crocker's work in practical electricity, and especially in the development of electric motors is well known, while his theoretical contributions to the science have invariably met with prompt recognition and respect. The New York Electrical Society, of which Mr. Crocker is now the president, was indebted to him last year for a valuable paper on "A Practical Method of Calculating and Designing Dynamos and Motors," and at their annual meeting of 1888, the American Institute of Electrical Engineers secured from Mr. Crocker a paper on "Chemical Generators of Electricity," which sustained his reputation for conscientious and reliable work.

Mr. Pupin stands first among the mathematicians who have graduated from Columbia in many years. He had the advantage of the tutorship of Helmholtz in Berlin for some time, while holding the Tyndall Fellowship.

PERSONAL.

Mr. A. H. Patterson, manager of the Phœnix Glass Company, is taking a well-earned rest in California.

The King of Italy has signed a decree providing for the appointment of a Minister of Posts and Telegraphs.

Col. H. C. Davis, ex-president of the Electric Club, sailed on the "Umbria" last Saturday for London, and will spend the summer abroad.

Mr. A. V. Garratt, secretary and treasurer of the National Electric Light Association, will act as secretary *pro tem* of the Electric Club, during the absence of the secretary in Europe.

Mr. Edward H. Fox, of the Phœnix Glass Company, was a Boston and Providence visitor last week. Mr. Fox makes friends for his enterprising company wherever he goes.

Mr. Enos M. Barton, president of the Western Electric Company, was one of the travellers for the Paris Exposition on the French ship "La Gascogne," Saturday, May 11th.

Mr. T. C. Frenyear, who is one of Mr. Burnham's right hand men, in the management of the business of the Electric Gas Lighting Company of Boston, is in New York on a business trip, with headquarters at the Astor House.

Mr. Chas. H. Davis, C. E., son of Col. Henry C. Davis, has opened an office in the Equitable Building, 120 Broadway, as consulting engineer. Mr. Davis is a young man of ability, experience and reliability, and the REVIEW wishes him the best of success in his work.

Mr. Henry Metzger, president of the Pittsburgh Telephone Company, was among the European passengers on the steamer "Umbria," which left New York Saturday last. Mr. Metzger expects to spend several months abroad visiting the Paris Exposition and other places of interest.

Prof. J. P. Barrett, the widely known electrician of Chicago, and Mr. Henry B. Cobb, president of the Cobb Vulcanite Wire Company, of Wilmington, Del., intend visiting the Paris Exposition together next month. The electrical fraternity will be strongly represented in Paris this year.

Mr. Norman Williams, of Chicago, the eminent attorney of that city, widely known in western electrical circles, has moved to a fine suite of offices in the Tacoma Building, where the firm will be known as Williams, Holt & Wheeler. The Chicago *Legal News* says: "The senior member of the firm, Norman Williams, is one of the best known and most popular of men at the Chicago bar. He is a son-in-law of ex-Chief Justice Caton. Messrs. Holt and Wheeler are good lawyers and abundantly able to keep up their end of the firm."

Mr. D. W. Baker, senior partner of the firm of Baker & Co., the platinum refiners, of Newark, N. J., sailed for Europe, accompanied by Mrs. Baker, on the "City of Paris," leaving New York Wednesday, May 15th, expecting to be absent about three months. The object of the trip is both business and pleasure, and will include an extended tour through Russia. Mr. S. T. Willcox, a member of the Electric Club, also sails at the same time, and will accompany Mr. B. through the greater part of his journey.

At a meeting of the board of directors of the Pennsylvania Telephone Company, held at their office in Harrisburg, Pa., on the 8th inst., J. R. Davis was appointed general manager *vice* J. B. Ker resigned. Mr. Davis is a civil as well as an electrical engineer, having been in charge of construction department of Pennsylvania R. R. work. He is thoroughly schooled in elictricity, and the two years' experience in electric lighting enables him to make an economical energetic manager. Mr. Ker, it is learned, goes to Dakota to engage in the cattle business with his brother William.

Telephonic News

*** Mayor Grant's private telephone line was cut on Monday by the pole choppers.

*** Sweden is said to have a better telephone service than any other country on the globe.

*** The annual reports published herewith of the New England and the Central Pennsylvania Telephone Companies will be found worth perusing.

*** The following is a statement of business of the New England Telephone and Telegraph Company for quarter ending March 31, 1889 :

Gross receipts for three months ending March 31, 1889	$290,504.75
Expenses for three months ending March 31, 1889	224,491.64
Net earnings for three months ending March 31, 1889	75,013.11
Construction for three months ending March 31, 1889	19,762.78

*** The Western Electric Company, of Chicago and New York, has been at work for a month setting the new multiple switch, with which the new telephone service is to be introduced by the Southern New England Company, at New Haven, Conn. The switch is a complicated looking affair, stretching down the center of the large room on the third story of the building, but though it is so formidable in appearance it is said that its operation is, in fact, simpler than the one now in use. The peculiar and valuable feature of this switch—that which gives it the name of multiple—is that it is within the power of each of the operators to reach each of the 1,250 subscribers in the New Haven division without calling on any other operator.

*** "Harry" Blanchard relates incidents which occurred while he was in the Western Union Telegraph Company's service in Rondout, as follows, in the *Kingston Freeman* : "The greatest annoyance to which an operator is subjected, probably, is the circumstance that wires sometimes become crossed, and cannot be used. One wire, however, can be worked clearly, but even that will not work unless all wires are open north and south of a given point where a dispatch is to be sent. I shall never forget the predicament I was in the day President Garfield was shot. Not a wire was working in the office. Patrons came in and wanted to send messages. At that time the Associated Press reports were received in the Western Union office. The press operator could not get a word of news. North and south of here the wires were crossed together and completely muddled up. Not a single wire worked. While watching the wires I believed I heard New York telling Haverstraw that Garfield had been assassinated. Th's I told the press operator, who immediately put on his coat, and in a few minutes the news was spread over the city. Of course I was not certain that it was true—it was guess-work. The office was soon crowded with people. 'Who killed him?' was asked a thousand times, but no answer could be given, as the wires were down. 'I never saw such an insolent operator!' muttered several, who wanted information and couldn't get it. In three or four hours afterward the wires were repaired and the news was confirmed. An instance of this kind tends to show how operators are sometimes wrongfully abused.

"One day a young woman came into the office with a package of knives and forks, which she said she desired to send by telegraph to New York city. I told her to go to an express office, but she insisted that she had been advised to send the package by telegraph, and that she 'was no fool.'

"Another annoyance is the man who wants to send a telegram to some city where the office is four miles from the place where the message must be carried, and he 'wants an answer in five minutes, too.'"

Annual Meeting of New England Telephone and Telegraph Company.

The annual meeting of the above company was held in New York, May 6th, and the following officers elected for the ensuing year :

Directors : Frederick Ayer, Benjamin C. Dean, William H. Forbes, John E. Hudson, Henry S. Hyde, Moses G. Parker, Stephen Salisbury, Thomas Sherwin, Albert O. Morgan.

Thomas Sherwin, president ; Henry S. Hyde, vice-president ; William R. Driver, treasurer ; Fred. J. Boynton, secretary ; Jasper N. Keller, general manager.

Executive Committee : John E. Hudson, Moses G. Parker, Thomas Sherwin.

The reports of President Sherwin and Treasurer Driver were submitted as follows :

Your directors present herewith a report of the operations of the company for the year ending December 31st, 1888. As shown by the treasurer's statement appended, the

Gross earnings for the year were	$1,127,307 40
Expenses	856,580 87
Net earnings	270,726 53

As compared with the results for 1887, there was

An increase of gross earnings	$115,936 86
An increase of expenses	129,861 94
A decrease of net earnings	13,925 08

While there has been a substantial increase in the revenue from all departments of the business, your directors have considered it for the interests of the company to apply a large part of the increase to the further improvement and reconstruction of the property. The amount of work performed during 1888 in the rebuilding of pole lines, replacing of wires, refitting of offices with improved equipment, substitution of aerial and underground cables for open wires, and in short, rendering the plant more serviceable and more durable, has been far in excess of that done in any previous year. This has involved an increase of expenditure in the items of repair and reconstruction over that of 1887, of some $90,000. A portion of the underground work has been charged to these accounts.

Of the amount chargeable to new construction, $171,752.66, three-fourths of the whole has been expended upon enlargement of the underground system in Boston, and the extension of extra-territorial and trunk-lines.

* * * * *

In the Boston Exchange, the large amount of underground construction forms the especial feature of the work accomplished during the year. The capacity of the old routes in Franklin, Pearl and Congress streets has been enlarged by the laying of additional pipes, and the system extended through new routes in Pearl, Franklin, Broad, Washington, Court, State, Commercial, Cambridge, Charles and Summer streets, Harrison avenue and Atlantic avenue.

The total length of street opened during the year was 26,188 feet, a portion being for enlargement of the iron system laid in 1882. Total length of ducts laid, 292,787 feet. This, added to the work completed in previous years, makes the entire length of streets through which the underground system of the company extends, 45,783 feet, in which ducts have been laid capable of receiving 95 miles of cable, enclosing 11,000 miles of single conductor.

During the year cables have been drawn into the ducts as follows :

1,166 feet, 200 conductor.
14,968 feet, 120 conductor.
14,852 feet, 100 conductor.

Of submarine cable there has been laid in Boston :

1,000 feet, 26 conductor.
310 feet, 25 conductor.

Of aerial cable there has been hung :

5,820 feet, 100 conductor.
7,362 feet, 50 conductor.
3,895 feet, 44 conductor.
2,666 feet, 32 conductor.
2,130 feet, 25 conductor.
300 feet, 10 conductor.

The total length of new cable of all classes placed in use in the Boston Exchange during 1888, is 54,549 feet. The length of underground wire reported in use at the close of the year was 1,580 miles.

Poles have been erected in the Boston Exchange to the number of 182, and 118 miles of wire strung.

Comprehensive plans have now been made for completing the underground work, and rights have been granted by the city for nearly all the streets through which it is considered advisable to place our wires under the surface. It is hoped that, before the close of the present year, conduits will have been constructed of sufficient capacity to carry all the wires which the company will find it expedient to place underground within the next ten years at least.

Rights for underground work in certain streets have also been granted by the city of Lowell, and it is proposed to begin the construction of conduits in that city at an early day.

The company has now in use in all its exchanges, 298,482 feet of cable carrying about 4,000 miles of copper wire.

In the inventory of supplies purchased during the year are included 2,397 bells, costing $17,835.30 ; 151,306 feet of aerial, underground, submarine, and office cable, $57,-213.86 ; batteries and battery material, $4,-367.09 ; 19,850 cross-arms, $5,857.66 ; 105,-103 insulators, $1,889.82 ; 4,052 poles, $14,335.35 ; switchboards and material therefor, $23,504.57 ; wire of all kinds, about 237 tons, $43,062.32 ; and other material of various classification, bringing the total cost of supplies purchased to $203,279.95, as against $104,000 for the previous year.

In addition to the above, 2,521 magneto bells have been refitted at a cost of $6,461.57.

The supply department, which had outgrown the limited quarters formerly apportioned it, has been removed to a suitable building No. 20 India Square, Boston, where accommodations are also afforded for the mechanical department. By thus bringing both departments under one roof and under one head, the time of employés is utilized to better advantage, and the work made more effective.

The expenditure upon the plant and equipment during the year has been :

For construction	$171,752 66
For reconstruction	99,983 40
For repair and maintenance	198,421 76
	$469,157 82
As against an expenditure for 1887 of	230,818 19

The mileage of exchange wires December 31st, 1888, was :

On poles	11,876 miles.
On buildings	2,364 "
Underground	1,580 "
Submarine	69 "
	15,889 "
An increase of	1,945 "

	Dec. 31, 1887.	Dec. 31, 1888.	Increase.
Exchange subscribers	14,240	15,536	1,296
Express "	547	549	2
Private line and agency stati's	2,569	2,847	278
Total stations	17,356	18,932	1,576

The increase in number of stations in 1887 was 1,151

To effect the increase of 1,298 in the number of exchange and express subscribers, as shown by the foregoing statement,

New subscribers have been connected	4,355
Subscribers have been disconnected	3,057
	1,298
The extra-territorial lines number	76
Miles of extra-territorial pole lines	2,167
Miles of extra-territorial wire	3,995
The number of regular employés of all classes is	518

The average number of local exchange connections daily in all the exchanges of the company is 72,659, or an aggregate for the year of 26,520,535.

The average number of calls per subscriber daily is 4¼, the number varying from 2½ in the smaller exchanges to upwards of 10 in the principal office in Boston.

The daily average of extra-territorial and toll messages is 1,465, a yearly aggregate of 534,725.

The electrical department has been occupied during the year in examining the condition of the several exchanges, making electrical measurement of the wires, locating disturbing causes, and devising such remedies as might remove or lessen the troubles to which our wires and the sensitive instruments which they connect are constantly subject. With the increased use of strong currents for lighting and other purposes in cities and towns where our exchanges are in operation, our service has been more exposed than in previous years to interference from induction and escape of those currents, from the wires strung in proximity to our own. Most of the companies using these currents have willingly made such changes in their system, upon the suggestion of the electrician of this company, as would, so far as possible, remedy the trouble which they caused. Your directors regret that this spirit of fairness and courtesy has not been found in all the companies making use of the disturbing currents, and some of our exchanges are still suffering seriously from this cause. In the interest both of our subscribers and of the company, it is the purpose of the management to have the evil remedied, so far as any means can be devised to that end.

Included in the work of the electrician's department has been the electrical measurement of all cables which have been put in use.

During the year patents have been issued to the company for the following inventions of Mr. Farnham :

No. 379,532, Test circuit and apparatus for electrical cables, dated November 26, 1887 ; granted March 13, 1888.

No. 380,752, Telephone transmitter, dated April 10, 1888.

A Canadian patent was also obtained for this transmitter.

No. 392,724, Electric circuit and apparatus guard, dated November 13, 1888.

No. 394,964, Electric switchboard, dated December 25, 1888.

The power generator system now in use in Boston has been considered sufficiently novel to be patented, and steps are now being taken in that direction.

The engineer's department has been occupied largely in preparing plans, testing material, and supervising the work of laying underground conduits. The important work of preparing accurate maps of all exchanges, showing the poles and wires of the company, in the various cities and towns through which our lines extend, has been undertaken and is still in progress.

Your directors are gratified to report that there has been no legislation in any of the States in which the company operates injuriously affecting its interests. We believe that in the various sections within which our business is conducted, the management of our officers has been such as to maintain the company in good standing and repute.

In very many of the cities and towns in which our exchanges are located, the municipal wires for fire alarm and signal purposes are carried upon our poles without charge, and in all cases, so far as we are advised, agreeable relations exist between the public officials and the representatives of the company.

The extension of the metallic circuit lines of the American Telephone and Telegraph Company to many of the principal exchanges of this company has afforded additional facilities to those of our subscribers in important business centers who have occasion to communicate with the large cities beyond the limits of our territory. This company has constructed lines of similar character to Portland, Manchester, Lowell, Worcester and other exchanges, and it is now possible for our subscribers in the larger cities to readily hold conversation with Philadelphia, New York, Albany, Buffalo, Rochester and intermediate points. As the business community becomes aware of the great advantage which this perfected system of telephoning offers, as it surely will when familiar with its successful working, we may look for a substantial and rapid increase of receipts from extra-territorial business.

Both in the growth of the business and the consequent large increase of revenue, the year has been a prosperous one, and, owing to the constantly improving character of the plant, we have suffered but little from damage to the property or interruption of service by reason of storm.

Your directors have consistently followed the policy which has been pursued during the preceding years, of strengthening the plant and, even at large expenditure from the gross revenue, placing the property in condition to afford the most efficient and prompt service to subscribers. We believe the wisdom of this course has been amply proved by the results. Charges have been made against the construction account only for expenditure which secured a distinct extension of lines or increase of capacity. All betterments upon or replacement of existing property has been charged to expense.

Since the payment of dividends was re-

sumed, at the beginning of 1886, the gain in number of subscribers has been as follows:

In 1886	679
In 1887	1,151
In 1888	1,576
Total increase	3,406

Increase of extra-territorial wire:

In 1886	56 miles.
In 1887	419 "
In 1888	484 "
Total increase	959 "

Increase in underground system:

In 1886, feet of underground ducts	98,730
In 1887, " " "	92,520
In 1888, " " "	292 787
Total increase	484,037

During this period there has been charged against the construction account:

In 1886	$37,819 49
In 1887	24,277 03
In 1888	171,752 66
Total increase	$233,849 20

Since the close of the last year, your directors have deemed it advisable to provide the necessary funds to cover the indebtedness already incurred on account of construction, and provide for further extension of the plant, by the creation of a funded debt. $500,000 of 10-year six per cent. bonds of the company have been sold, with the provision that in each of the years 1894, 1895, 1896, 1897 and 1898, the company will redeem $50,000 of these bonds, on proposals submitted by the holders, at a price not to exceed 102 per cent. and accrued interest. The sum thus realized should suffice, after payment of the temporary indebtedness, to provide for the large amount of construction which it will be advisable to complete during the current year.

During the year 1888 there has been paid in dividends, $284,651.61.

In conclusion your directors have to congratulate you upon the continued prosperity of the company, the improved condition of your property, the satisfactory character of the service, except at points before referred to, where trouble is experienced from interference of electric light and power currents, and upon the promising outlook for the growth of business in the future.

The following is an estimate of the cost of maintenance and extension of the plant for the year 1889:

For construction	$200,000 00
For reconstruction	84,000 00
For repairs	200,000 00
	$484,000 00

Comparative statement of earnings and expenses, from treasurer's statement:

EARNINGS.

	1887.	1888.
Agency	$38,882 49	$45,190 63
Exchange	851,869 70	946,664 79
Extra-territorial & toll line	92,242 38	102,246 28
Miscellaneous	8,820 80	9,372 15
Private line	17,828 95	22,077 35
Telegraph commissions	1,726 22	1,756 20
	$1,011,370 54	$1,127,307 40

EXPENSES.

Expenses of repair and maintenance	$159,553 35	$198,421 76
General expenses	52,155 97	60,888 25
Instrument rental	203,939 17	223,210 99
Insurance and taxes	51,072 35	50,181 25
Interest		2,415 44
Miscellaneous	6,805 00	11,348 33
Operating	162,642 86	166,555 29
Postage, Printing and Stationery	8,337 35	10,721 55
Rebates	19,445 44	17,341 85
Reconstruction	46,987 79	98,983 40
Rents	15,859 65	16,512 26
	$726,718 93	$856,580 87
Net earnings	$284,651 61	$270,726 53
Undivided earnings, December 31, 1887		$127,151 61
Net earnings of 1888		270,726 53
		$397,878 14
Dividends paid in 1888		284,651 61
Undivided earnings, December 31, 1888		$113,226 53
Surplus account, January 1, 1888		$369,790 42
Adjustments		3,735 30
Surplus account, December 31, 1888		373,525 72

LEDGER BALANCES DECEMBER 31, 1888.

DEBTORS.

Licenses	$4,268,000 00
Plant	6,181,244 65
Unissued stock	1,605,400 00
Trustee stock	251,000 00
Stocks and Bonds	23,000 00
Construction (for the year 1888)	171,752 66
Office furniture, teams and tools	15,417 84
Bells, materials and supplies	168,485 12
Accounts receivable	137,765 41
Cash	21,301 76

CREDITORS.

Capital stock	$12,000,000 00
Surplus account	373,525 72
Income account	113,226 53
Reserve accounts	91,935 20
Unpaid dividends	419 25
Bills and accounts payable	244,360 74
	$12,823,367 44 $12,823,367 44

Net gain of agency subscribers for the year 1888.. 278
Net gain of exchange " " " " " 1,298

The Central Pennsylvania Telephone and Supply Company.

This company, through its board of directors, makes the following report for the year 1888:

The fiscal year of your company ending December 31st, 1888, has been one of quiet and steady development of the telephone business.

Early in the season your territory was increased by the addition of the county of Elk, it having been transferred from the territory of the Central District and Printing Telegraph Company, subject, however, to return to that company after twelve months' written notice from either party to the other, or from the American Bell Telephone Company, but on such terms as are considered equitable and which are set forth in detail in the original transfer.

The capital has been increased during the year to a maximum of 8,000 shares by the issue of 51 shares, at par for cash, for use in the extension of lines. Quarterly dividends of 1½ per cent. have been paid on the capital outstanding at the several periods, and were as follows:

January 28th	$11,923 50
April 30th	11,923 50
July 28th	12,000 00
October 27th	12,000 00

Attention is called to the report of the treasurer herewith submitted, and by which it appears that the gross earnings for the year were $163,781.40; expenses, $105,324.82; leaving net earnings of $58,456.58, being an increase of net earnings over the year previous of $1,954.98. In making up the expense account all taxes were included, and deducted from the earnings. If the plan of comparisons for previous years had been followed in this instance, the increase of net earnings for the year would appear to be $5,554.38. There has been an increase of expenses over the previous year of $9,401.97. This should be accounted for by the legitimate enlargement of the business in part; but greatly by the expense attendant in consequence of changes, made necessary at various points to protect the property from the influence and danger of high current circuits of other companies, newly erected, and, also, by increased switchboard facilities for Wilkesbarre and Williamsport, and the moving of Williamsport central office to new quarters.

The prospects for the current year are considered quite favorable.

STATEMENT. December 31st, 1889.

ASSETS.

Cash on hand	$15,742 93	
Supplies on hand	3,250 79	
License	275,100 00	
Construction and equipment	525,008 04	
Due from sundry persons	2,802 42	
" exchange managers	5,503 14	
Furniture	1,980 93	$829,388 25

LIABILITIES.

Capital stock	$800,000 00	
Toll line tickets outstanding	1,447 50	
Advance rentals	1,125 96	
Due to sundry persons	4,008 08	
Surplus	8,283 16	
Net earnings	14,523 55	$829,388 25

An Ingenious Call-Bell.

Mr. Jos. Gillet Noyes, manager of the New Haven Clock Company, is the inventor of a very ingenious electric call-bell possessing advantages of simplicity, and little danger of getting out of order, having but few parts and but one magnet. A view of the bells is shown in the accompanying illustration. Without going into details its operation is as follows: When the circuit is closed by pressure of an exterior button or otherwise, the armature is drawn to the magnet causing the clapper to strike the bell. The magnet armature and small screw which

THE NOYES CALL-BELL.—FIG. 1.

touches the contact piece carried by the armature, when in its normal position, are all in circuit, but when the forward movement of the armature takes place the circuit is broken. When the armature returns again to normal position, the contact piece again touches the screw closing the circuit and causing a repetition of the whole operation. Thus a continuous ringing of the bell is obtained so long as current enters the instrument.

Swindled by Wire Tappers.

At Birmingham, Ala., last week, the pool rooms lost heavily on races where they thought they had a sure thing. Wire-tapping was suspected, and Manager Williams, of the Western Union Telegraph office, was asked to investigate the matter. He put his linemen at work, and to-day they discovered how the races had been beaten. The Western Union office is on the first floor of a four story building. There is a basement under the office, and through this all wires enter the room above. Some one had attached a fine wire to the Western Union wires in the basement, run it through the outer wall, thence to the roof, then down a chimney to a vacant room on the fourth floor of the building. In this room the wire was attached to an instrument, and the circuit was so arranged that the reports of the races intended for the pool rooms could be doctored.

PROFIT AND LOSS ACCOUNT.

For the year ending December 31st, 1888, compared with Fiscal year 1887.

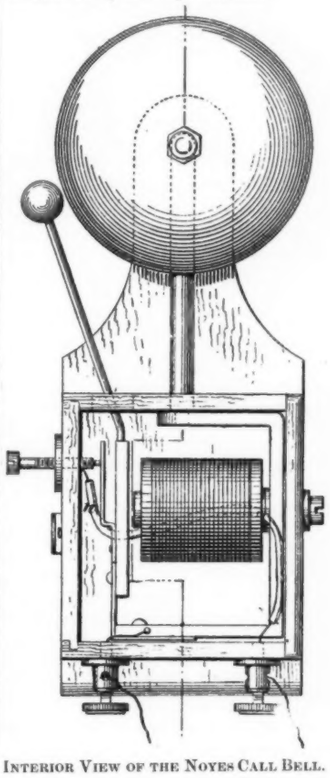
	Dec. 31st, 1887.		Dec. 31st, 1888.	
CENTRAL PA. DIVISION EARNINGS:				
Exchange	$65,808 27		$71,756 60	
Private line	3,663 78		3,819 28	
Extra territorial	5,727 39		6,020 67	
Miscellaneous	1,172 87	$76,372 31	1,442 74	$83,039 29
NORTH PA. DIVISION EARNINGS:				
Exchange	65,446 04		73,350 56	
Private line	4,177 83		4,200 00	
Extra territorial	2,006 66		2,153 31	
Miscellaneous	821 61	72,452 14	1,038 24	80,742 11
		$148,824 45		$163,781 40
EXPENSES.				
General		8,502 41		12,607 74
CENTRAL PA. DIVISION:				
Exchange	$39,990 57		$45,194 90	
Private line	2,500 44		2,520 77	
Extra territorial	410 38		402 01	
Division	1,020 00	43,921 39	1,138 02	49,255 70
NORTH PA. DIVISION:				
Exchange	36,352 49		39,869 82	
Private line	2,480 06		2,516 68	
Extra territorial	86 58		131 47	
Division	979 92	39,899 05	943 41	43,461 38
		$92,322 85		$105,324 82
SUMMARY.				
Total earnings		$148,824 45		$163,781 40
" expense		92,322 85		105,324 82
Net earnings		$56,501 60		$58,456 58

TELEGRAPHIC

.... A proposition from the Gamewell Company for an electric fire alarm has been submitted to the Board of Aldermen of Batavia, N. Y.

.... Judge Simonston, of Harrisburg, Pa., to-day decided that the Western Union Telegraph Company cannot remove its suit to enforce forfeiture to the United States Court. He also decided that electric light companies are not manufacturing corporations since they do not produce a material substance and that their capital is therefore liable to taxation.

.... The Western Union company is very active in the building line this spring and has large gangs of linemen at work throughout Connecticut. Thousands of poles have been recently distributed along the Naugatuck road from Newington to Hartford. The lines along the entire length of the Naugatuck road and from Newington to Hartford will practically be rebuilt.



INTERIOR VIEW OF THE NOYES CALL BELL.

.... The Western Union Telegraph Company commenced the work of burying a portion of its wires in Buffalo, Tuesday morning. The first section dealt with is that from the main office corner of Main and Seneca streets to Pearl street. A ditch three feet deep is being dug into which the wooden receivers are to be placed. These receivers which are about 12 feet long are bored through its length with a two inch hole. A cable with about 50 wires will pass through this tube connecting with manholes placed at convenient distances.

. . . By orders issued by the Western Union and Postal Telegraph Companies, long-distance rates at many points have been reduced, while for short distances the rates have been advanced slightly. The most important part of the new orders is, however, the elimination of the Mutual Union Telegraph from the field, all the Mutual Union offices being either closed or turned into Western Union offices. It was thought that this new movement indicated a closer alliance between the Postal and the Western Union, but the officials of the Postal Company state that that company does not lose its independence under the new arrangement. It has no interest in the Western Union, and the Western Union has no interest in the Postal.

* * A school of electrical engineering has been established in connection with Columbia College and was formally opened Monday last.

* * Northampton, Mass., is discussing buying its plant, and a local committee has a formidable array of figures bearing on the subject.

* * The Hartford Dynamic Company are to put a new electric street car on the Farmington avenue line in Hartford. The Detroit storage batteries will be used.

* * The Watervliet Turnpike Company of West Troy, N. Y., was granted the privilege of erecting poles on which to stretch its wires for its proposed electric motor system.

* * Mr. Erwin, who has been soliciting subscriptions for the electric railway from North Albina, W. T., to East Portland, has been very successful, and has received subscriptions to the amount of nearly $15,000.

* * President Lewis, of the Brooklyn City Railroad, E. W. Bliss, of Bay Ridge, E. D. White and Frank Lyman, of Brooklyn, visited Boston on Monday to search for a motor system to be used on the Third avenue line in place of dummies.

* * The Beverly and Danvers Electric Street Railway Company has cleared the ledges upon its line to Danvers. It will not use the overhead wire, but will use the storage battery system. Locations have been granted in Danvers and Beverly for the line.

* * President Whitney says that the West End Street Railway Company, of Boston, will extend the electric system as rapidly as possible. At present he is not prepared to say in what streets the system will first be carried, although Roxbury will early receive attention, a line from Charlestown to Franklin Park being one of the most important projects.

* * The annual election of officers of the Woonsocket Electric Machine and Power Company was held Monday, with this result: President, A. W. Buckland; secretary and treasurer, Levi C. Lincoln; directors, Edgar K. Ray, James Murray, Willard Kent, Chas. E. Thomas, Oscar E. Morse, Samuel P. Cook, Jonathan B. Farnum. Levi C. Lincoln was re-engaged as manager.

* * Mayor Hart has not yet signed the order granting the West End Railway Company the right to use the overhead electric system in operating its cars in all the streets of Boston. As a result of the conference on Tuesday, the West End company will execute an agreement to reimburse the city for any expense caused by damage to the fire alarm and police signal wire.

* * The Superintendent of the Great Northern Railway, King's Cross, London, has ordered from Robbins & Appleton, London, 20 Waltham non-magnetic watches for use of the engineers and guards of the famous Scotch Express train on that road known as the Flying Scotchman, whose time between London and Edinboro is 60 miles an hour, inclusive of stops.

* * During last week the Sprague Railway and Motor Company, of New York, have contracted to build an electric railway to cover the principal streets of Portland, Oregon. This will make the third electric railway operated by the Sprague Company on the Pacific Slope, the other two being at Tacoma, Washington Territory. The car equipment will include the latest Sprague type of lightning arrester and universal movement trolley arm.

* * The committee on street railways of the Massachusetts legislature, Senator Tucker and representatives Shaw and Witt dissenting, reported a bill that "no street railway company which runs its cars upon the surface of any street or streets in any city of more than 60,000 inhabitants, according to the census of 1885, shall in such city erect, maintain or use wires or other electric conductors running above the level of such street or streets.

* * The construction of the electric plant by which power will be furnished for propelling the cars of the Troy and Lansingburgh, N. Y., Horse Railroad Company by electricity will be under the supervision of E. D. Arnold, consulting engineer of the Troy Steel and Iron Company. Two Corliss engines of 150 horse-power each will be placed in the building to be erected east of the Lansingburgh barn on the bank of the Hudson river, and two Babcock boilers will be placed in the boiler house.

* * The electric road at Spokane Falls, W. T., is nearly completed, and when running will be one of the finest roads in the West. The officers of the company are: President, G. B. Dennis; vice-president, E. J. Webster; secretary, C. L. Marshall; general manager, H. N. Belt; treasurer, S. Heath; trustees, G. B. Dennis, S. Heath, Cyrus Bradley, R. W. Forrest, C. R. Burns, A. P. Wolverton, I. S. Kaufman, W. H. Marshall, T. F. Conlan and H. N. Belt.

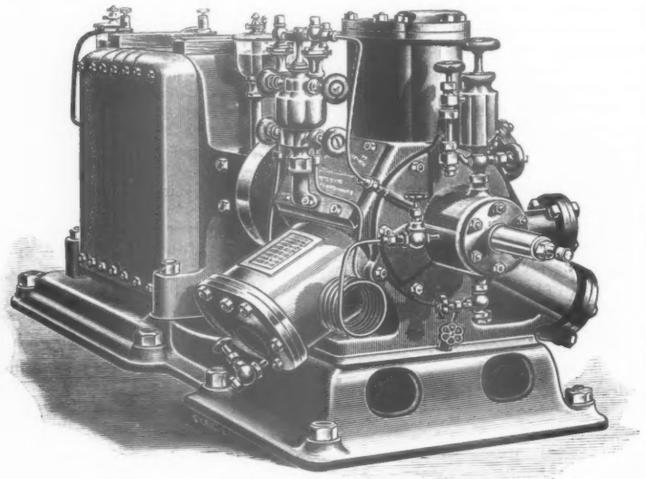
* * During the past week the street railway companies which are about adopting the electric system for operating their cars have not been idle, and the Sprague Electric Railway and Motor Company, of New York, report a number of new contracts closed during the past week. One of these is at Plattsmouth, Neb., where the Plattsmouth Street Railway Company have closed their contract at Kearney, Neb., for a complete electric rail way equipment. The Pennsylvania R. R. have been so well pleased with the operation of the Sprague cars at Atlantic City, N. J., that they have ordered 10 more complete trucks. In Binghamton, N. Y., the Washington Street and State Asylum R. R. has closed a contract to equip their line.

* * In a recent test of one of the new Sprague motors, made at the factory of the Sprague Electric Railway and Motor Company, at Schenectady, N. Y., one of the armatures was placed in a tub of fresh water and allowed to soak there for 24 hours. It was then taken from its bath and put into position in the machine and worked up to full load without developing any defect. After this treatment it was again removed from the machine, and placed in a tub of salt water, where it was allowed to remain for another 24 hours. It was then again placed in the machine, and after wiping the commutator, the motor was worked up to over 33 per cent. above its normal load for two to three hours, it is claimed, without showing any defect or bad result of its treatment.

A Compact Plant for Railway Trains.

The beautifully appointed train which brought President Harrison from Washington to New York to attend the Centennial celebration, was lighted throughout by electricity. Current was furnished by a plant which is probably as compact as any ever operated and marks a step in advance in this particular field. The illustration shows the plant complete, consisting of a Brotherhood 15 horse-power engine and an Eickemeyer dynamo, furnished by J. H. Bunnell & Co., of New York.

The engine cylinders are four inches by three inches, and the entire bed plate occupies but very little space. The dynamo generated 80 amperes at a pressure of 80 volts. The plant was in charge of Mr. A. H. Bauer, chief electrician of the Pullman Company, and during the trip the President carefully examined its workings and was much interested in the electrical details. He expressed himself as much pleased with the satisfactory way in which the train was lighted.



J. H. Bunnell & Co.'s Electric Plant for Railroad Trains.

The People's Telephone Suit.

SERVICE OF PAPERS OUT OF THE COURT'S JURISDICTION SET ASIDE.

Judge Biddle, in Court of Common Pleas No. 1, of Philadelphia, last week delivered an opinion in the suit of the People's Telephone Company, incorporated under the laws of New Jersey, against the American National Telephone Company, of New York, and Edward A. Quintard, James W. Bonta, Frederick T. Chandler and George Romaine, making absolute the rule to set aside and vacate any alleged or pretended service upon the defendant corporation and the degree pro confesso, which required the American Company to make a full disclosure of the patent it controls and how the test was made, which Godfrey Keebler and Joseph F. Stokes claim was a fraud upon them, and also required that the agreements between the two companies be declared void and that the American Company return the $15,000 paid to it by People's Company together with damages which may been sustained by the People's Company.

Judge Biddle, in his opinion, said: "There can be no doubt that neither by the act of 1849 nor the act of 1851 can there be any valid service of process within our jurisdiction upon a foreign corporation unless it is doing business within our limits or has an agency or place of business here. The validity of the service made in this case, therefore, depends upon whether the defendant company has an agency or has done business in this State. What the secretary of the complainant company chose to return as to the service he made has, of course, no such significance as a return by the sheriff. In answer to the affidavits of the president, treasurer, secretary and the three served directors of the defendant company that it has never done business elsewhere than in the city of New York and that it has never had an agency or transacted business within this State, the complainant seems to rely upon the allegation that the contracts which the respondents have made will require them to come into this State to execute them.

"As the present bill, however, is brought against them for not complying with these contracts, the necessity of coming into this State has evidently not yet arisen. When it does, we think then will be the time to serve the proper process upon them."

The Spalding Telegraph Company to Begin Work Soon.

The incorporators of the Spalding Telegraph Company, which was incorporated by the General Assembly at Dover at its recent session, met at Wilmington, Del., last week. The incorporators are: Henry C. Conrad, Esq., John T. Dickey, John W. Aydon, Henry Spalding of Boston, and John G. King of Baltimore.

It was reported that all the capital stock of the company, $100,000, had been subscribed by the incorporators, who will meet again next Friday to effect an organization.

Section 2 of the act of incorporation sets forth the object of the company as follows:

"That this corporation is formed for the purpose of owning, leasing, constructing or operating a line or lines of telegraph or telephone through this State, or from or to any point or points within this State, or upon the boundaries thereof, by constructing and laying its wires underground, which wires are to be used for telegraph or telephone, or for either or both of said purposes, and the said corporation is hereby authorized and empowered to construct its line or lines and lay its wires underground through this State, or from or to any point or points within this State, or upon the boundaries thereof, and along and under any postal roads, or postal routes, roads, streets and highways, or under and across any pavements or sidewalks for the purpose of making connections with buildings, or across any of the bridges, or through or under any of the waters within the limits of this State, and also to lay underground with said wires the conduits or pipes in which the same are to be enclosed, and any boxes or other connections or appurtenances to be used therewith," etc.

The act also gives the company the right to lease, sell or convey any of its franchises or interest thereon, or any part thereof, to any telegraph or telephone company, as also the reciprocal power to acquire the property, franchises, etc., of any telegraph or telephone company, or to "consolidate with any other telegraph or telephone company or incorporation of this or any other State."

The Spalding Company is also incorporated in Maryland and Pennsylvania. The idea is to begin within a month or two to place the wires underground between Washington and New York, beginning at the former place. Seven wires will be laid and it is probable that the companies of Maryland, Delaware and Pennsylvania will be consolidated and the capital stock increased as much as necessary.

The Chesapeake and Potomac Telephone Company Obtain a Franchise at Baltimore, Md.

The Mayor has signed the ordinance granting permission to the Chesapeake and Potomac Telephone Company to lay conduits for underground wires. The company is to pay to the city annually for the franchise 30 cents for each linear yard of the first four miles of conduits, and 20 cents for every additional yard, and in every underground conduit space shall be provided, if required, free of cost, for a cable for the use of the police and fire alarm telegraph. It is understood that the company will begin the work as soon as the necessary arrangements can be made.

Telegraph Companies in Litigation.

The United Lines Telegraph Company has filed an answer in the Superior Court at Cincinnati, O., to the petition of Edward Harlan, receiver of the American Rapid Telegraph Company, wherein $225,000 is claimed for the use of plaintiff's wires, poles, etc., since July 30, 1885. It is claimed that the American Rapid Company is now the property of Edward A. Stokes. It is further claimed that the whole subject of controversy is now in litigation in the Supreme Court of the United States, the suit having been recently appealed thereto from the Circuit Court of New York. John A. Mackey is on the appeal bond for $95,000.

The R. T. White Rail and Chair.

Shown in the accompanying illustration is an interesting product for street railway people, especially those who are adopting electric motive power. The cut shows the new double girder or channel iron form of rail secured on a chair by a bolt passing through the pendant sides of the rail and through the upper end of the chair. The chairs are placed at suitable intervals along the rails between the joints, and a similar chair of greater length is used at the joints of the rails for connecting them together, thus making substantial joints. The chairs are set on and secured to wooden sleepers by lag screws, as shown, but the wooden sleepers may be dispensed with by enlarging the base of the chairs sufficiently to give them a solid bearing when two feet in the ground, or they may be set in concrete. In this case, tie rods would be used to hold the rails to gauge. The advantages of such a system, both in simplicity of construction and ease of repairing and its substantial features, recommend it for general adoption. Mr. White will roll rails to conform to the ordinances of any city or town.

Congress of Applied Mechanics at Paris.

There will be held at Paris, at the Conservatoire des Arts et Métiers, an International Congress of Applied Mechanics, under the patronage of a Committee of Honor, comprising savants and engineers of renown both from France and from other countries, who will give the work of the congress the benefit of their influence and the weight of their authorities. The President of the Committee on Organization is Mr. Phillips, ex-inspector general of mines (retired). The five members appointed from the United States are, in the order of their mention on the official bulletin, Messrs. Robert Grimshaw (president Polytechnic Section Am. Institute, N. Y.), R. H. Thurston (director Sibley College of Cornell University, Ithaca), Prof. Egleston (Columbia College School of Mines, N. Y.), and the presidents of the American Societies of Civil and of Mechanical Engineers. At this congress, among the important subjects submitted for discussion are the unification of the horse-power, the choice of materials in machine construction, the mechanical production and utilization of artificial cold, transmission to a distance, and distribution of work, by other means than electricity (water, air, steam cables, etc.), automatic cut-off engines with several successful cylinders; thermo-motors other than the steam engine. Other topics, treated by papers, will be improvements in steam engines since 1878, progress among associations of owners of steam appliances, and improvements in apparatus for the generation of steam, more particularly sectional boilers.

More Aluminium Works.

It appears that the production of aluminium on the electrical system is being pushed on vigorously abroad. Thus the Austrian Länderbank and the Allgemeinen Elektricitäts Gesellschaft have purchased a patented process which is to be carried on in the Alpine district, and water power will be used to drive the machinery again. The Société Electro-Metallurgique, is erecting works at Froges, Iséres, France, for the manufacture of aluminium by the Heroult process. Current will be supplied by two dynamos, each of 7,000 amperes and 20 volts. Motive power is derived from two turbines of 300 horse-power, while the daily output of the works is computed at three tons.

He Smelled the Electricity.

A young man who returned from the Sound was telling a friend about the electric motor road he saw. He said it was a grand success, the only think wrong about it was that the electricity stunk awfully. New electric motors are varnished with shellac and when they first get warmed up the shellac emits a rather unpleasant smell, but a man needs a long nose to smell the electricity.

—— Following are the officers of the Amherst Electric Light Company: President, Frank E. Paige; directors, George Cutler, W. W. Hunt, Frank P. Wood, George P. Warner; secretary, C. F. Dewell; treasurer, George P. Warner.

—— The joint finance and light committee of the Alexandria, Va., council have awarded the contract at $13,500 for the putting in of an electric plant to light that town to the Schuyler Electric Light Company, which has furnished the electric light for Hagerstown, Md. The contract will come up next week for ratification by the city council.

—— The Moorestown, N. J., Electric Light, Heat and Power Company has elected the following directors: Rev. J. H. Lamb, E. W. Perkins, Geo. W. Heaton, John S. Rogers, Rufus Hill, Albert C. Heulings, J. S. Riehle, William H. Roberts and Dr. P. Wilson. President, Rev. J. H. Lamb; vice-president, E. W. Perkins; treasurer, Albert C. Heulings; secretary, J. S. Rogers.

—— Leonard & Izard, electrical engineers, of Chicago, have just closed a contract to wire a building for 600 lights for the N. K. Fairbank Company, using the T.-H. system. This is a very difficult piece of wiring, as the lard, grease and soap are very detrimental to the best known insulations. The same firm has just completed the installation at the car docks at Escanaba, Mich., for the Chicago and U. W. Railway Company.

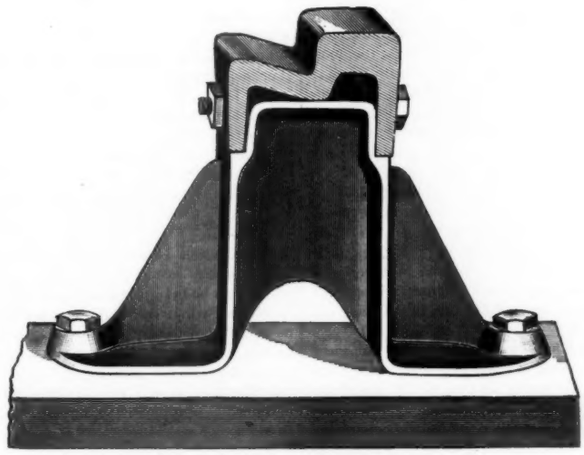
—— The contract for all the street lighting in Woburn, Mass., has been awarded for three years to the Woburn Electric Light Company, at $6,500 per year.

—— Electric lights for the big freight steamers seem to be the coming thing. The steamer "Progress," when aground at the St. Clair Flats, Mich., used her electric lights to great advantage in lightering a part of her cargo.

—— Two years and a half doesn't seem a long time, and the fact that during that period the Westinghouse Electric Company have sold 170 central station plants, alternating current system, indicates the push and enterprise of its managers.

—— The streets of Winchester, Va., were successfully lighted last week by the Schuyler electric light system by the Winchester Gas and Electric Light Company. In honor of the event there was a grand parade of the military and the fire department in full uniform.

—— The Thomson-Houston Electric Company has secured the lighting of the boulevards of Paris. It has already contracts for Panama, Venzuela, Bogota, U. S. of Columbia, Guatemala and Central America, as well as a large business in Australia, Japan and Buenos Ayres. The increase of business during the past year has been truly marvelous, the present business being 100 per cent. larger than a year ago.



The R. T. White Rail and Chair.

Judge D. Tucker Brooke, of Norfolk, Va., of the Corporation Court, granted a charter last week to the Edison Electric Light and Power Co., of Norfolk. The company is composed of Messrs. D. Lowenberg, Richard B. Tunstall, George Tait, J. W. McCarrick, M. L. T. Davis, Luther Sheldon, J. C. Everett and C. Brooks Johnston. The principal office is to be in Norfolk and the capital of the company is to be not less than $15,000, nor more than $500,000, divided into shares of $100 each. The officers named for the first year are: D. Lowenberg, president; Richard B. Tunstall, vice-president; George Tait, treasurer, and C. Brooks Johnston, secretary.

——The Westinghouse Electric Company report the following sales of alternating current central station outfits during the first week in May: Asbury Park, N. J., 500 lights; Galesburg, Ill., 500 lights; Salem, N. J. (increase), 500 lights; Batavia, N. Y., 1,250 lights. The same company recently took orders for Waterhouse arc lighting plants as follows: Fort Worth (Tex.) Electric Light Co., 35 lights; Allegheny County Lighting Co., Pittsburg, Pa., 50 lights; Hartford (Conn.) Light and Power Co., 30 lights; American Waltham Watch Co., 3 lights; State insane asylum, Columbia, S. C., 5 lights and a 200-light direct current incandescent dynamo. Two machines of the latter class were sold also, one of 100 lights to Huntindon Hopkins Co., San Francisco, and one of 150 lights to the Charlotte (N. C.) Oil and Fertilizer Co., for isolated plants.

—— The street lighting committee last week awarded the contract for lighting the streets to the Pittsfield, Mass., Electric Light Company, its bid being the lowest. The company will continue the present 42 arc lights, with possibly some new ones, and will also put in about 200 16 candle power incandescent lights in place of the gas lamps now in use. These lights will be burned to 12.30 o'clock each night, according to the Philadelphia schedule. The company will be compelled to enlarge its plant, and a new dynamo will at once be put in. Under the new contract outlying portions of the town will be much more generally lighted than at present.

—— A franchise for laying underground conduits for electric wires in San Francisco was granted to P. K. Canavan, C. I. Hutchinson, O. F. Willey, John Lyons and W. C. Doane, Nov. 25, 1881. This franchise also gave the right to lay pipes for salt water or compressed air. It runs until 1931, any streets can be used, and no expenditures need be made to hold the franchise. Another franchise for a conduit for electric wires for all purposes was granted on the same date to Geo. S. Ladd *et al.* This franchise is also unlimited and runs until 1931. A third franchise was granted to the California Electric Light Company similar to the Ladd franchise. It was granted March 30, 1882, and runs until 1932. These are the only underground franchises that have been granted, and they are practically unlimited, except as to date of expiration.

ELECTRIC LIGHT NEWS

—— The Western Electric Co. is putting in a lighting plant at Holley, N. Y.

—— A Westinghouse 500-light incandescent plant is being put in at Corvallis, Ore.

—— Auburn, N. Y., is thoroughly discussing the numerous bids received for electric lighting.

—— There are in use by the City of Albany, N. Y., for city lighting, 730 arc lights and 220 incandescent.

—— A contract for 10 years has been made with the Salt Lake Power, Light and Heating Company, for lighting the streets of Salt Lake City, Utah.

—— The West Troy, N. Y., trustees last week awarded the contract for lighting the village by electric lamps to the Mutual Electric Light Company of Brooklyn.

—— The Westinghouse Electric Company has obtained the contract to put 500 arc lamps along the streets of Philadelphia. The lamp is of the Waterhouse patent.

—— Macon's, Ga., electric lights will be pushed now that Mr. George Work, of Philadelphia, has complete control of the Gas Light and Water Company.

—— The Electric Light Company of Lyons is negotiating for the Shuler water privilege for a new station. The work of stringing wires for lighting the village is already in progress.

—— The Northampton, Mass., Electric Light Company is now running wires to Florence, preparatory to introducing the incandescent system in that village, 150 lights having been ordered already.

—— Mr. C. B. Story, of Brunswick, has purchased a controlling interest in the Dexter Electric Light Company, and it is said that he proposes to form a new companyto operate the lights in Dexter village.

—— The Woburn board of aldermen settled the controversy between the Woburn telephone and electric light companies by granting the latter company a location on a separate set of poles on Main street to the Winchester line.

—— At a joint meeting of the stockholders of the Putnam Electric Light and Gas Company, Monday, a consolidation was effected. The company will probably be known as the Putnam Light and Power Company. The following officers were elected: President, Frank W. Perry; secretary, treasurer and superintendent, Allen W. Bowen; directors, Augustus A. Houghton, Frank W. Perry, J. W. Manning, Charles E. Searles, S. H. Seward, A. W. Bowen and George E. Hammond.

—— Work has been begun on the Middleboro Electric Light and Power Company's plant at the upper dam on Water street, and is progressing rapidly. The Middleboro Gas and Electric Company is getting ready to enlarge its works in order to put in dynamos preparatory to furnishing electricity to light the streets according to its contract. The gas commissioners will be in town May 23d to settle the dispute with regard to the erection of poles by either or both of the above companies, as both have been granted the privilege by the selectmen.

Electrolysis by Alternating Currents.

The priority of observations on this subject is claimed by E. Drechsel in *Beiblatter*. He notes that the explosion of the gases is not caused by heating of the electrodes, as the same phenomenon occurs when the electrodes were of fusible metal, which afterwards show no trace of fusion.

KINDRED INTERESTS

MANUFACTURING NOTES.

The Partz Electric Battery Company, of Philadelphia, Pa., are in the hands of a receiver, Walter George Smith, 524 Walnut street, who is winding up the affairs of the company by order of the court it is stated.

The National Conduit Manufacturing Company.—The cement lined iron pipes of this company are coming into very popular use. A large order of 100,000 feet has just been placed for New York City, and several good orders from other cities have recently come in. The Boston order is a large one, and the work of laying the pipe commenced there this week.

The Cobb Wires and Cables.—The cables of the Cobb Vulcanite Wire Company are being put into the underground conduits of New York in large quantities, extending along Broadway and Sixth avenue, from 14th street to 59th street. This company has orders from Chicago amounting to 50 miles. The factory at Wilmington, Del., is very busy filling orders, and has fine facilities for splendid work on short notice.

The Wyckoff Pipe Company, of Williamsport, Pa., manufacturers of Wyckoff patent conduits, have the order from the Western Union Telegraph Company for the conduits which the latter company is putting in in Buffalo, N. Y., for placing their wire underground. Work has already begun on this contract at the Williamsport shops and the magnitude of the order is shown by the fact that several car loads of material will be shipped.

The Thomson-Houston Company system now in use on the Cambridge division of the West End Street Railway, Boston, make the following showing for the month just passed.

This road has a previous record of but nine trips lost out of 1,179.

The following report is for the month of April:

Average number of motors in daily service	8
Round trips of motor cars	2,730
Time in service motor cars	3,332 hours
Mileage of motor cars	17,680 miles.
Round trips, one tow car	2,720
Round trips, two tow cars	226
Time in service, towed cars	3,500 hours 30 minutes.
Mileage of towed cars	19,149 miles.
Total car round trips	5,666
Total car mileage	36,829 miles.

Of the above round trips but 7 were lost.

The Armington & Sims Engine Company held its annual meeting at its Providence office last week. The treasurer presented his annual report, showing a largely increased prosperity through the year and a large number of unfilled orders on hand. Notwithstanding the force has been largely augmented, it has been unable to keep up with the demand at any time during the year. An especially gratifying feature of the business is the growing demand for the engine for use on board of vessels of the United States Government. Quite a large number of the engines are now in use in the navy, and several are now in process of construction. Orders also continue to arrive from Europe. The customary semi-annual dividend of three per cent. was declared. At a meeting of the directors, held subsequently, James E. Cranson was elected president; J. W. Danielson, vice-president; Pardon Armington, treasurer; H. C. Cranston, assistant treasurer; Gardiner C. Sims, general manager; Theodore Andrews, secretary.

The Westinghouse Machine Company's immense establishment at Pittsburgh, Pa., covering two and one-half large squares and making use of over $700,000 in the conduct of its business, is an attractive point for visitors from all over the world. The company seems to make no secret of its system of manufacture, and it is a curious fact that many of its visitors are its active and prominent competitors in the same field. The product of the company is exclusively steam engines whose prominent feature is that they are capable of transmitting their entire power for actual work. All sizes are manufactured, many being carried in stock at all times, and each engine is tested before being put on the market. The selling department is interesting, if from nothing but its size, including as it does general agencies in all parts of the United States, Maritime Provinces of Canada, Mexico, Central America, South America, Australia, Italy, Spain, France, Holland, Denmark, Norway and Sweden, Russia and the Kingdom of Prussia, while agency contracts are now in negotiation for England, India, Turkey, Japan, etc.

The Westinghouse Machine Company pays its "erectors" $18.00 per week, while similar workmen in England receive only $6.00 per week; it pays what is called "shop labor" $12.00 per week, while similar workmen in England receive only $3.60 per week. It was, therefore, a matter of considerable surprise to our editorial staff that this company could market its engines in Europe and in the British Colonies in direct competition with the largest English, French and German builders. Its ability to do this lies, of course, in the fact that the engines themselves have attractive features, being capable of lubricating themselves, regulating themselves, transmitting their entire power on to actual work (by reason of their high initial speeds), and at the same time doing these things with a minimum consumption of fuel. But perhaps the most important reason for the company's ability to compete with foreign builders is the same which enables the Baldwin Locomotive Works to ship its product abroad in competition with Europeans, to wit: the thoroughness of the system of manufacture.

Three distinct types of engines are now made, namely, the Junior automatic cheap engines in six sizes, 5 to 50 h. h.; the Standard Westinghouse automatic engines, in 13 sizes, 5 to 250 h. p., and the Westinghouse automatic compound engines, either condensing or non-condensing, in 16 sizes, 5 to 500 h. p.

It is food for reflection for American thinkers that in order to obtain prompt dispatch for goods sent to South American, Australian and other distant agencies, they must first be shipped to England, and thence by the various steam lines to their respective destinations.

A Song After Lamplight.

(As sung by the Swinburnian Gas-share-holder on reading a report of the inquiry now being held as to the working of the Electric Lighting Acts of 1882-1888).

The end has come of all our fume and fretting,
As, darkness deep'ning round us, O my brothers,
We watch this sun of ours sink to its setting
To herald an uprisen light to others.

No more the stream from poisoning meter seething
Shall stay and stint the stifling air around us,
Till it with breath of death, in this our breathing,
Through sense of cheating choke and gasp confound us.

No more! For spite the living load of blunder
That crushes life from every golden measure,
The "main" at length is riven—rent in sunder,
And scattered to the winds its hoarded treasure!

So hail, to fair Electric Installation!
No fear that it will find us mute to meet it.
Invaded, we will yield it habitation
And grovel in our gratitute to greet it.

Hail to its shares! and what, then, of those others?
"*Gas* will go down." Nay, class me not with jokers,
When I advise you, strongly, O my brothers!
To wire that one word "sell" straight to your brokers.
—*Punch.*

*** The telegraph and telephone wires have been removed from the poles on Court street, Brooklyn, from Remsen street to Atlantic avenue, and on Livingston street, from Boerum place to Court street, and placed in conduits, so that the poles at the above places will be removed.

From an editorial in *The Electrician*, London: "At the Paris Exhibition we shall hope to hold our own notwithstanding the national jealousies which are never wanting in the French capital, and the extravagant preference which appears to have been shown to rival exhibits from the other side of the Atlantic.

A Telegraph which Produces a Printed Sheet.

Our lively contemporary the London *Electrical Engineer*, says that the tape telegraph or "ticker" now so common at clubs and brokers' offices is practically doomed, and "flimsy"—the written messages sent out from the telegraphic news offices—is likewise soon to be a thing of the past, by reason of the practical introduction on a large scale of the new typewriting telegraph of Messrs. Moore and Wright in the offices of the Central News Agency at Ludgate-hill. This instrument has been practically tested for some little time past, and we had recently an opportunity of inspecting the instrument at work, and of ascertaining what is its scope, and what is intended to be done with it. The instrument, indeed, fulfills a "long-felt want." The origin of the invention has been, as a matter of fact, the constant complaint from newspaper men of the difficulty of dealing quickly and easily with the news as now delivered. Either it comes in strips, which have to be cut up and pasted together; or it comes in "flimsy," and is liable to tear and smudge when sent up to the compositors. Messrs. Moore and Wright who are connected with the Central News Agency, therefore, some 18 months ago started to construct a telegraph which would print its message in lines on a sheet instead of a strip. This instrument they have perfected, and are intending to fit them up in the offices of their subscribers—the newspapers and clubs of London—to the number of some 220, as soon as they can be got ready. The instrument is in reality an electric typewriter, but having one keyboard and any number of sets of typewriters. The keyboard, at present, is arranged like an A B C telegraph, but it has only to be fitted with a keyboard similar to the ordinary typewriter for anyone used to the latter instrument to be able to work the transmitter. The receiver has a type-wheel, controlled by an electro-magnet in the same way as the usual tape telegraph, but at every letter the type-wheel is pushed one space along the shaft. The motion of the type-wheel is actuated by a train of wheels, and a second magnet and train of wheels can be brought into play at the end of the line, which causes in one motion the paper to be pushed up and the type-wheel to go back to the beginning of the line. The appearance of the message, printed on a broad coil of paper, is exactly similar to that of an ordinary type-written message, and is, therefore, of great superiority to the tape for news items, or notices for exhibition in clubs, while quotations for stocks and shares can thus be printed in columns for use at once. The receiver is quite as ingenious as the transmitter. A small electro-motor revolves, by means of a lightly-resting friction-wheel, a reversing electric contact. This keeps the magnet of the receiver constantly vibrating. As the button belonging to each letter or sign is depressed, this revolving contact is stopped at the letter, and the type at the receiver end is struck on the paper. At the end of the line a slightly stronger current is sent by momentarily cutting out a resistance, and then by another button the circuit is open. The result of the first is to excite the auxiliary magnet of the receiver, which attracts a catch on a pinion, while opening the circuit releases the catch. The second train of wheels comes into operation, shifting the paper and the type wheel at the same time to begin a new line. The receiver costs about £19, but it is not intended to sell them, but to hire them out in the usual manner as with tape insruments. The Central News Agency will put down a gas-engine and accumulator to work the series of instruments from Ludgate-hill, and it is expected that they will be ready to work about August.

Gender of the Phonograph.

[From *Judge.*]

The phonograph is feminine,
I'll tell you how I know;
When once wound up it talks and talks,
In an unceasing flow.

It cannot keep a confidence,
But lets the secret out;
And yet it never seems to know
What all its talk's about.

Perhaps you think my arguments
Both rhyme and reason lack;
But here's the most convincing proof—
It always answers back,

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 7, 1889.

402,562 Electric signaling apparatus; John P. Coleman, Swissvale, Pa.

402,563 Method of treating underground electrical conduits with chemical substances; Arthur E. Colgate, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill.

402,565 Conduit for electric wires; George W. Cook, Detroit, Mich., assignor of one-third to Charles C. Canny, same place.

402,586 Distribution of electricity by secondary batteries; William W. Griscom, Haverford College, assignor to the Electro Dynamic Company, Philadelphia, Pa.

402,592 Electric wire insulator; Arthur W. Heaviside, Newcastle-upon-Tyne, England.

402,613 Electric bell; William K. Rainey, New Orleans, La.

402,626 Electrical annunciator; Benjamin Smead, Chicago, Ill.

402,639 Polarized relay; John C. Wilson, Boston, Mass.

402,642 Testing apparatus for fire alarms; John Young, Chicago, Ill., assignor to the Western Electric Company, same place.

402,671 System of electrical distribution and conversion; Thomas H. Hicks, Detroit, Mich., assignor to the Hicks Induction Light and Motor Company, of Michigan.

402,684 Magnetic separator; Hiram S. Maxim London, England.

402,717 Telegraph instrument; Charles G. Burke, Richmond Hill, N. Y.

402,752 Insulator; Frederick M. Locke, Victor and John Lapp, Honeoye Falls, N. Y.

402,753 Cut-out; Osborn P. Loomis, Somerville, Mass., assignor to the Loomis Electric Manufacturing Company, New York, N. Y.

402,754 Automatic circuit controller for electric lights; Osborn P. Loomis, Somerville, Mass., assignor to the Loomis Electric Manufacturing Company, New York, N. Y.

402,810 Supporting and cross-connecting electric wires; William J. Denver, Boston, Mass.

402,823 Electric clock; Emil G. Hammer, Brooklyn, N. Y.

402,828 Circuit closer for railway car telegraphs; George I. Hopkins, Manchester, N. H.

402,829 Coupler for electric conductors; George I. Hopkins, Manchester, N. H.

402,832 Electric railway; Rudolph M. Hunter; Philadelphia, Pa.

402,836 Insulator and holder for electric railways; Byron Jennings, San José, Cal.

402,890 Electric or cable railway car; Sumner A. Bemis, Springfield, and Louis Pfingst, Boston, Mass.

402,904 Magnetic separator; Gurdon Conkling, Glenns Falls, N. Y.

402,912 Rheostat; Joseph B. Entrikin, Des Moines, Iowa.

PATENTS.

Electrical Review Patent Bureau

Conducts a general business in the preparation and prosecution of Applications for Patents, in the United States and all Foreign Countries. All business carefully and promptly attended to in the matter of Reissues, Caveats, Trade Marks, Labels, Design Patents, Copyrights.

SPECIAL SEARCHES made to determine the question of novelty or infringement.

ELECTRICAL PATENTS A SPECIAL FEATURE. All business receives the direct personal supervision of the Manager, whose fourteen years' experience as Patent Attorney and seven years as Practical Electrician, insures thorough and satisfactory work.

All communications are strictly confidential, and inventors may address us with entire freedom.

Our charges will always be as moderate as first-class work will permit and commensurate with the amount of work to be done.

Address,

Electrical Review Patent Bureau,

13 Park Row, N. Y. T. J. McTIGHE, Manager.

PROPOSALS WANTED.

PROPOSALS for lighting by electricity the city and suburbs of Matanzas Island, of Cuba, will be admitted at the Consulate General of Spain. The contract will be awarded at 2 P. M. on the 1st day of June proximo, simultaneously at the Government House, Havana, and City Council, Matanzas. For conditions and specification apply at this Consular office. **MIGUEL SUAREZ,**

Consul General of Spain.
30 Broadway, N. Y.

New York, May 11th, 1889.

AMERICAN
Leather Link Belt Co.

"American Patent Joint"

Leather Link Belting

Specially adapted to DYNAMOS.

FACTORY, 46 & 48 FERRY ST., OFFICE, 72 CLIFF STREET, NEW YORK.

NEW YORK. CHICAGO, BOSTON. PHILA.

Sperry Electric Company,

Factory, 194 to 198 So. Clinton St., Chicago, Ill.

MANUFACTURERS OF THE

Improved Sperry High and Low Tension Systems of Arc Lighting,

Claiming the Highest Efficiency, Reliability and Durability. Perfect Regulation.

WANTED.—Machinery to build. Specialties in CAST IRON to manufacture. Fine solid CASTINGS for Dies, Moulds, Dynamos, Motors, &c.

MANUFACTURER,
P. O. Box 886,
NEW HAVEN, CONN.

CONDENSERS

WM. MARSHALL, MANUFACTURER.
Standards a Specialty
Rooms 2 and 4, University Building, New York.

THE LEHIGH VALLEY
CREOSOTING CO.
PERTH AMBOY, N. J.

Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

NOTICE TO THE TRADE.
A. L. BOGART,

22 Union Sq., N. Y.,

Is the sole owner of U. S. Patents covering certain Electrical Gas-Lighting Burners, Cut-Offs, Burglar Alarm, Gas-Lighting Attachments, and other electrical appliances connected therewith, all of which are manufactured exclusively by him, and are sold to the trade on the most favorable terms EXPERTS will use none other, on account of their superior workmanship, and practical utility.

Suits are now pending in the U. S. Circuit Courts against infringers of the Bogart Patents in the cities of New York, Philadelphia and Boston.

Illustrated Circulars, price-lists and discount sheets forwarded to the trade on application, accompanied with business card.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.
AMERICAN ELECTRICAL WORKS

MANUFACTURERS OF
Patent Finished Insulated
ELECTRIC WIRES,
TELEPHONE AND ELECTRIC CORDAGE,
Electric Light Wire, Magnet Wire,

PATENT RUBBER COVERED WIRE, OFFICE AND ANNUNCIATOR WIRE, LEAD-ENCASED WIRE, ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES, ETC., ETC.

OFFICE AND FACTORY, No. 67 STEWART ST., PROVIDENCE. R. I.
New York Office: 18 Cortlandt St., P. C. Ackerman, Agent.

Detroit Electrical Works

MANUFACTURERS OF
ELECTRIC SUPPLIES,
INCLUDING
Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins and Brackets.

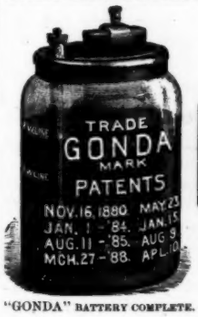
Insulated Magnet, Telephone and Electric Light Wire.

GENERAL OFFICES and FACTORY:
DETROIT, MICH.

SEND FOR CATALOGUE.

THE WYCKOFF PIPE CO.,
MANUFACTURERS OF
WOODEN PIPES FOR
UNDERGROUND ELECTRICAL WIRES.
We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.
WILLIAMSPORT, PENN.

DO NOT BE IMPOSED UPON.
EVERY GENUINE POROUS CUP IS STAMPED WITH OUR LABEL AND TRADE MARK.



"GONDA" BATTERY COMPLETE.

TRADE
GONDA
MARK.

GENUINE "GONDA POROUS CUP" BATTERY COMPLETE.

THESE ALONE ARE THE GENUINE BATTERIES
Cut out this Card and use it as a Guide when Buying.
THE LECLANCHE BATTERY CO., 149 W. 18th Street, N. Y.

— THE —
Microphone Carbon Battery Co.,
OF NEW YORK.

Has acquired all rights and privileges under letters patent No. 393,814, authorizing the manufacture and sale of the celebrated Microphone Cell.

THE MICROPHONE CELL

Is warranted to be of stronger and longer life than any other Sal-ammoniac battery made. Its electromotive force is maximum; its internal resistance minimum.

TRADE
MICROPHONE.
MARK.

Microphone Carbon Battery Co.,
112 LIBERTY STREET,
NEW YORK.

Microphone Carbon Battery Co.,
112 LIBERTY STREET,
NEW YORK.

THE MICROPHONE CELL

Has the endorsement of the best authorities, who proclaim it to be an efficient battery, and for all open circuit purposes, one of unexceptionable value.

Infringements of any kind upon these patents will promptly be acted upon to the extent of the law.

— THE —
Microphone Carbon Battery Co.

is manufacturing these cells in large quantities, and will keep on hand a full stock at their warerooms, No. 112 Liberty Street, New York.

The Julien Electric Company,

STORAGE BATTERIES FOR LIGHT AND STATIONARY POWER.

THE JULIEN ELECTRIC TRACTION COMPANY,

ELECTRIC TRACTION BY STORAGE BATTERIES,

Offices, 120 BROADWAY, NEW YORK.

TERRITORY FOR SALE ON FAVORABLE TERMS.

Bernstein Electric Co.

INCANDESCENT LAMPS

— FOR —

ARC LIGHT CIRCUITS,

SIMPLE. RELIABLE. DURABLE.

The only safe socket for series lamps and the only socket having insulating material for the outside parts.

Send for Illustrated Catalogue.

620 Atlantic Ave., BOSTON.

WRITE

For the Electrical Review's *New Catalogue* of all Electrical and Scientific Books.

18 PARK ROW, NEW YORK.

Plating Machines that require a speed from 1800 to 3600 revolutions per minute are Useless Toys.

$100.00

THE

"LITTLE WONDER"

DYNAMO-ELECTRIC MACHINE.

Over 1000 in Successful Operation. Has the largest sale of any Electro-Plating Machine.

SEND FOR CATALOGUE OF 1889.

Manufactory and Offices,

Newark, N.J.

New York Office, 32 Liberty Street.

NEW YORK BELTING AND PACKING CO.

WAREHOUSE: 15 PARK ROW, NEW YORK.

The Oldest and Largest Manufacturers in the United States of

VULCANIZED RUBBER

In every form adapted to mechanical purposes.

MACHINE BELTING,

With Smooth Metallic Rubber Surface

This Company has Manufactured the Largest Belts made in the World for the principal elevators at Chicago, Buffalo and New York.

We make a Superior Quality of Belting for Electric Light purposes, for use on Dynamos and Swift running machinery.

JOHN H. CHEEVER, Treasurer.

BRANCH HOUSES AT BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS,
European Branch: Pickhuben 5, HAMBURG, (Freihafengebiet), GERMANY.

Washburn & Moen Mfg. Co.

WORCESTER, MASS.

MAKERS OF

IRON AND STEEL

MANUFACTURERS OF

Iron and Copper Wire for Electrical Purposes.

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

Since the first introduction of the Electric Telegraph Service, our patent wire, expresely manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse.
16 CLIFF STREET.

Chicago Warehouse,
107 & 109 LAKE ST.

S. Y. L'HOMMEDIEU & CO., Eastern Agents, 65 Reade St., N. Y.

S. Y. L'HOMMEDIEU & CO., Eastern Agents, 65 Reade St., N. Y.

FARADAY CARBON CO.,

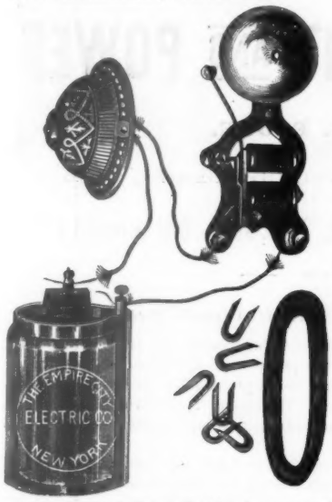
ELECTRIC LIGHT CARBONS,

PITTSBURGH, PA.

EMPIRE CITY ELECTRIC COMPANY,

15 DEY STREET, NEW YORK.

O. E. MADDEN, *President.*
E. T. GILLILAND, *Vice-President.*



New York, May 14th, 1889.

DEAR SIR:

The question of the BEST BATTERY in all respects for "open circuit" work is always an important one, we keep on hand in quantities all makes, varieties and kinds of **"Batteries"** and all at reasonable prices, but first we will mention a battery of OUR OWN MANUFACTURE which we have specially designed for **Electric Bell** and gas lighting work. We call it the **"Empire City Disque" Battery** and claim it to be the best made for the purpose, we also offer same at very reasonable figures, our CUSTOMERS who are using this battery praise it very highly. EVERY CELL WARRANTED. We only ask a trial. We also sell **"Daniels," "Bunsen," "Carbon," "Day Batteries," "Crowfoot," "Gravity," "Fuller," "Hussey," "Lockwood," "Grenet," "Smee," "Diamond," "Gonda," "Grove," "Bichromatic," "Bisulphate of Mercury," "Bell," "Law," "Dipping," "Medical."** etc. etc. batteries.

Our SAL AMMONIAC is 95 per cent. PURE, and IMPORTED DIRECTLY by us from GERMANY.

WRITE FOR PRICES.

Yours etc.,

THE EMPIRE CITY ELECTRIC CO.

MANUFACTURERS AND DEALERS IN

Telegraph, Telephone, Electric Light

— AND —

ELECTRICAL SUPPLIES

OF EVERY DESCRIPTION.

All kinds of Bare and Insulated Wires and Cables, Batteries, Bells, Annunciators, Burglar Alarms, etc., Insulators, Pins, Brackets, Cross Arms, etc.

INCANDESCENT LAMPS of best make to fit any socket.

CARBON POINTS of best Foreign and Domestic Manufacture.

WHITEWOOD MOULDING and CLEATS at low prices.

NEW CATALOGUE JUST PUBLISHED.

In Fact, Everything in the Electrical Line

Estimates Cheerfully Furnished. Correspondence Solicited.

Discount Sheet furnished to any one in the Trade on application.

E. P. Gleason Manuf'g Co.

181-189 MERCER ST., NEW YORK.

MANUFACTURERS OF

Electric Light Appliances, Fittings, Insulated Joints, Fixtures,

GLOBES, SHADES, FANCY LAMPS,

ETC., ETC., ETC.

SEND FOR CATALOGUE E. AND SUPPLEMENT.

Warerooms, 224-232 Canal St., 118-126 Walker St., NEW YORK.
Manufactory, Flushing & Carlton Avenues, Brooklyn.

OXLEY, GIDDINGS & ENOS,

DESIGNERS AND MAKERS OF

Electroliers and Combination Fixtures

UNSURPASSED FACILITIES

For producing fixtures of the most approved designs for any system of

INCANDESCENT LIGHTING.

Special designs furnished upon application. Suggestions from architects and decorators faithfully executed.

Porcelain Electrical Supplies and Specialties,

MANUFACTURED BY

EMPIRE CHINA WORKS,

144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.

Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL, and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES.

D. W. Baker. Cyrus O. Baker, Jr.

BAKER & CO.,

Importers, Melters and Refiners of

PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

---

POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, CHICAGO, KANSAS CITY AND OMAHA.

This is the Dust-Proof Washer.

BUY NO **BELLS** WITHOUT IT.

THE TRENTON ENGINE.

AUTOMATIC CUT-OFF,
BALANCE VALVE,
POSITIVE EXHAUST.

ECONOMY, DURABILITY AND CLOSE REGULATION GUARANTEED.

PHŒNIX IRON CO., Trenton, N. J., B'ldrs
F. Van Winkle, 91 Liberty St. N.Y. Agent.

ROOT

ELECTRIC GAS LIGHTER.

By this system of Electric Gas Lighting, house and fixture wiring are dispensed with. Each light is complete and independent. Full information will be given on application.

Liberal terms to agents,

Root Electric Gas Lighting Co.,

Rooms 612, 613 and 614, 225 Dearborn St., Chicago.

BAIN, 76 Market Street, CHICAGO, ILL.,

General Electrical Work, in all branches of Electrical Engineering. Consultation, etc. Correspondence confidential. TRY ME.

HAZAZER & STANLEY,

ELECTRICAL HOUSE FURNISHINGS,

32 & 34 FRANKFORT STREET,

NEW YORK.

WRITE

For the Electrical Review's *New Catalogue* of all Electrical and Scientific Books.

18 PARK ROW, NEW YORK.

THE DOUBLE CYLINDER LAW BATTERY.

THE STANDARD FOR ALL OPEN CIRCUIT WORK.

ITS NINTH YEAR.

The Negative Element has 147 square inches of surface which is more than double the surface found in any other! The Cell contains 2½ pints of solution which is nearly double that in any other cell!

4¼ ins. square, 7¼ ins. high.

No Running Over or Creeping of Salts.
No Evaporation.
No Corrosion.
No Renewal of Negative Element.
Requiring no Care.
Costing nothing for renewals except for zinc and solution (a trifle) in from two to four years.
White Flint Glass Jar.
Black Rubberoid Cover.
Lock seal top.
Pure Zinc.
Pure Sal Ammoniac.
Fewest Parts.

THE LAW BATTERY IS KEPT IN STOCK AND FOR SALE BY ALL RELIABLE SUPPLY HOUSES.

AGENTS: GEO. L. HENZEL, San Francisco, Cal., for Pacific Coast,
HIBBARD ELECTRIC M'F'G & SUPPLY CO., Montreal, for Canada.
CHAS. A. STRELINGER & CO., Detroit, Mich., for Detroit.

THE LAW TELEPHONE CO., Sole Makers,
112 LIBERTY STREET, - - - - - - - - NEW YORK.

AMERICAN ELECTRICAL DIRECTORY FOR 1889

PRICE, $5.00.

The best and most permanent medium for advertisers in the electrical field.

The work reaches every electric light and power company in the country, besides telegraph and telephone companies.

This year's issue enlarged and improved.

Lists and reports of electric light and power companies, reports of National Electric Light Association, useful tables, etc., etc.

Send orders for copies of book, and for advertising space to ***STAR IRON TOWER CO.***, Publishers of

American Electrical Directory, Fort Wayne, Ind.

Westfield Mass

MANUFACTURERS OF

Polished & Dressed Threads

Yarns in the Grey and in all Numbers and Colors.

We make a Specialty of Threads for Covering Wires for Electrical Purposes.

Samples Sent on Application. *Correspondence Solicited.*

NEW PUBLICATION.

ECONOMIC VALUE

OF

ELECTRIC LIGHT AND POWER.

By A. R. FOOTE.

Address: P. O. Box 673, Cincinnati, Ohio.

12mo. Handsomely bound in Vellum Cloth. Price, $1.00. Sent on receipt of Price.

From the MANUFACTURERS' RECORD, Baltimore.

This handy and popular treatise should be in the hands of every well-informed American. It is an attempt to present, in a popular way, the merits and applications of Electricity as a source of light and power, with especial reference to its use for the purposes of municipalities and manufacturers. The author is a thorough master of his subject, and in the compass of about two hundred pages, groups a variety of information not to be elsewhere easily obtained.

The volume deals with the Arc and Incandescent Light, the relations of Electricity and Gas, the Electric service of Cities, Electric Motors, and other applications of the new power. Much of the information afforded is in the shape of practical essays by well known specialists in Electro-Dynamics. Other questions discussed are Municipal Ownership of Commercial Monopolies, Municipal Management of Manufactures, State and Municipal Legislation, Economic Aspects of Trusts, and Joint Stock Associations. The volume contains also, a valuable appendix, in which mechanical and electrical terms are explained in untechnical language. The work is designed principally to benefit those interested in obtaining municipal franchises, promoters of Electrical enterprises, and manufacturers of Electric Supplies, Motors, Machinery, etc. Its general interest, however, should make it a popular publication.

EDISON AUTOMATIC DYNAMOS
GIVE ABSOLUTELY PERFECT REGULATION.

Recent tests of four ***Edison Automatic Dynamos*** in multiple arc show constant pressure at the lamps with load varying from no load to full load, without any adjustment of brushes, regulators, or any parts whatever.

Specially adapted for lighting Theatres, Hotels, Asylums, Stores, etc.

Among the plants in which the ***Edison Automatic Dynamos*** have been installed may be mentioned the following:

Drexel Building, Philadelphia, 2,000 lights.
Barnes, Hengerer & Co., Buffalo, 1,600 lights.
Star Theatre, Buffalo, 800 lights.
National Theatre, Philadelphia, 1,000 lights.
United States Gunboat "Yorktown," Cruisers "Baltimore" and "Charleston," and Steamer "Pensacola," and a number of other plants.

Edison Automatic Dynamos are now being installed as follows:

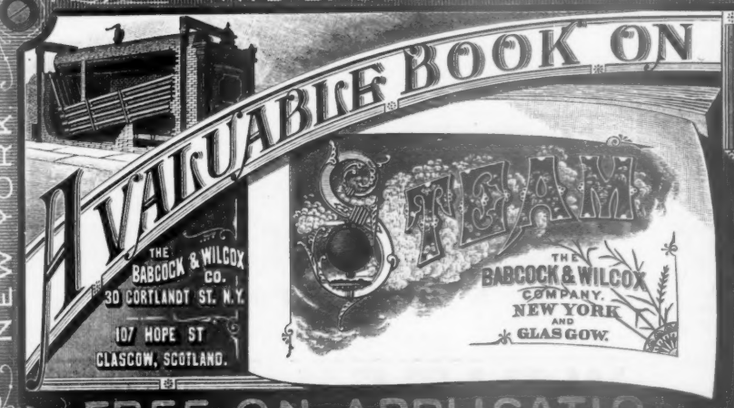
New Depot of the Central Railroad of New Jersey, at Jersey City, 2,000 lights.
Steamer "Puritan," of the Fall River Line, 1,600 lights.

Send for Circulars on any class of isolated or Central Station Lighting. Estimates and Specifications Promptly Furnished.

THE EDISON UNITED MANUFACTURING COMPANY,
65 Fifth Avenue, New York.

THE BABCOCK & WILCOX CO.

NEW YORK, J. GLASGOW.


A VALUABLE BOOK ON
STEAM
THE BABCOCK & WILCOX CO. 30 CORTLANDT ST. N.Y.
107 HOPE ST GLASGOW, SCOTLAND.
THE BABCOCK & WILCOX COMPANY. NEW YORK AND GLASGOW.

FREE ON APPLICATION

WATER TUBE STEAM BOILERS.

BRANCH OFFICES.
BOSTON, MASS. 8 OLIVER ST.
PHILADELPHIA, PA. 32 N. 5TH ST.
CHICAGO ILL. 45 S. JEFFERSON ST.
NEW ORLEANS LA. 57 CARONDELET ST.
SAN FRANCISCO, CAL. 561 MISSION ST.
LONDON, ENG. 114 NEWGATE ST.
MANCHESTER, ENG. 9 VICTORIA BUILDING
PARIS, FRANCE. 20 BOULEVARD VOLTAIRE.
HAVANA, CUBA. 116½ CALLE DE LA HABANA.
MELBOURNE, AUSTRALIA

BROWNLEE & CO.,
DETROIT, MICH.
DEALERS IN
CEDAR TELEGRAPH POLES.
MANUFACTURERS OF
Cross Arms, Pins and Brackets, Oak and Locust Pins, CEDAR TIES, For Electric Railways.

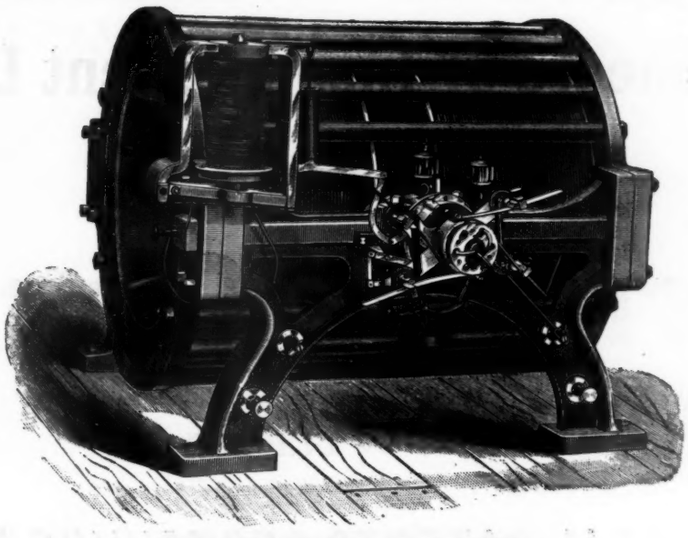
W. R. OSTRANDER & CO.
21, 23 & 25 ANN ST., NEW YORK,
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS, Electric & Mechanical Bells.
FACTORY,
De Kalb Avenue,
BROOKLYN.
Send for Illustrated Catalogue.

THE

THOMSON-HOUSTON ELECTRIC CO.,

MANUFACTURER OF

ARC LIGHT DYNAMOS



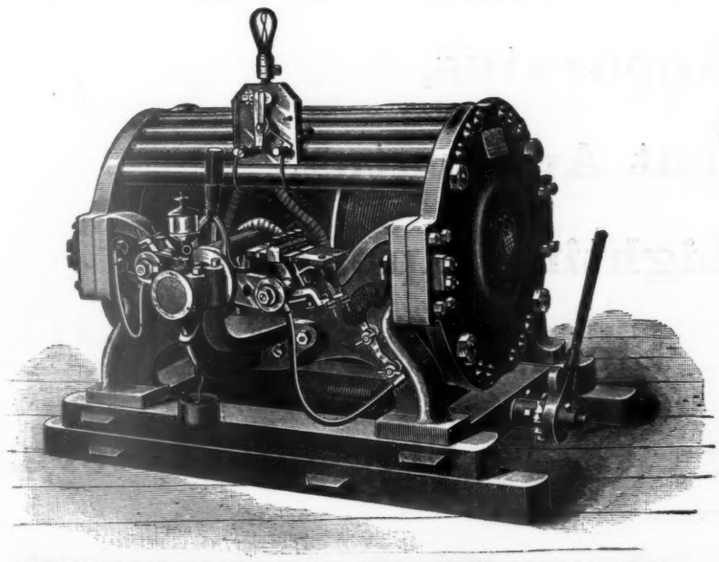
THOMSON-HOUSTON ARC DYNAMO.

Dynamos Automatic in Regulation under all Changes of Lead. Simple in Construction and Economical in Operation.

ARC LAMPS

SINGLE OR DOUBLE. PLAIN OR ORNAMENTAL.

Direct and Alternating Current Incandescent Dynamos.



THOMSON-HOUSTON DYNAMO FOR INCANDESCENT LIGHTING.

Incandescent Lamps,

Electric Meters,

Sockets, Switches,

Cut-Outs,

And all Necessary Appliances.

THE THOMSON-HOUSTON ELECTRIC CO.,

620 ATLANTIC AVENUE, BOSTON, MASS. 148 MICHIGAN AVENUE, CHICAGO, ILL.
WALL AND LOYD STREETS, ATLANTA, GA.

THE

WESTINGHOUSE ELECTRIC CO.

PITTSBURGH, PA.

The Pioneers of Incandescent Lighting

BY

Alternating Currents

AND OWNERS OF

FUNDAMENTAL PATENTS PERTAINING THERETO.

COMPLETE CENTRAL STATION OUTFITS

Alternating Current Apparatus,

Direct Current Apparatus,

Arc Lighting Apparatus,

Electric Motors,

Electric Meters.

170 Central Station Alternating Current Plants have been sold by the Westinghouse Electric Company in less than two and a half years.

OFFICES IN ALL LEADING CITIES.

THE

WESTINGHOUSE

ELECTRIC CO.,

PITTSBURGH, PA.

The United States Electric Lighting Co.

[Leased and Operated by The Westinghouse Electric Co.]

SALES DEPARTMENT, 120 BROADWAY, NEW YORK.

ARC AND INCANDESCENT APPARATUS

— FOR —

ISOLATED LIGHTING

EFFICIENT APPARATUS.
ECONOMICAL LAMPS.
INGENIOUS DEVICES.

THE

Sawyer-Man Electric Co.

510 West 23d Street, New York.

Incandescent Electric Lamps,

— AND —

SUPPLIES FOR ELECTRIC WORK.

Electric AND Combination Fixtures.

CORRESPONDENCE WITH DEALERS INVITED.

MORAL. Don't Buy Wire or other Supplies for Electric Light or Power Plants before inspecting our Illustrated Electric Light Catalogue, and writing us for Quotations.

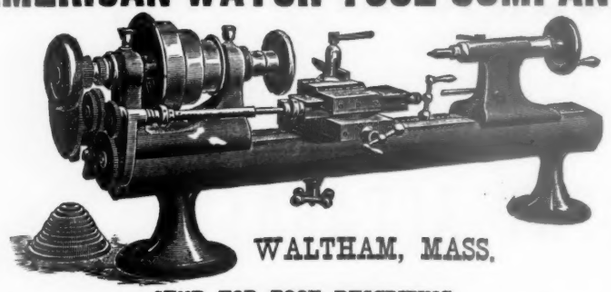
THE ELECTRICAL SUPPLY COMPANY,

ANSONIA. CHICAGO. BRANCH OFFICE.

Factories and Eastern Office, ANSONIA, CONN. Warehouse and Western Office, 171 Randolph St., CHICAGO. 505 Delaware Street, KANSAS CITY.

EASTERN SELLING AGENTS, T. F. HUNTER & CO., 37 CHURCH STREET, NEW YORK.

AMERICAN WATCH TOOL COMPANY



WALTHAM, MASS.

SEND FOR BOOK DESCRIBING

Grinding, Screw Cutting, and other Special Fine Tool Making Accessories.

The Question of the Hour!

Next to the interest in the lighting of a city, the public demands rapid transit, and grasps with avidity anything calculated to enhance it.

"THE ELECTRIC RAILWAY,"

BY FRED H. WHIPPLE,

Is a new and original Book upon the subject, designed especially to inform the practical business man without the use of mystifying technical terms, and formulæ.

There is information in it of value to the owner, the officer and the employe of every street railway or user of power for any purpose.

Price, Paper Cover, $1.00.
Bound in Flexible Russia, $2.00.

PROFUSELY ILLUSTRATED.

This Book treats of Electric Power in all its phases.

FRED. H. WHIPPLE, DETROIT, MICH.

Send your name, business and address, and be correctly reported in Whipple's National Electrical Directory.

JARVIS ENGINEERING COMPANY,

CONTRACTING ENGINEERS for ERECTING COMPLETE STEAM PLANTS

For Electric Lighting and Power Stations.

—: AGENTS FOR :—

ARMINGTON & SIMS ENGINES,
JARVIS BOILER SETTING,
to burn Anthracite Coal and Coke Screenings,
NATIONAL FEED WATER HEATER,
NATIONAL ROCKING and
SHEFFIELD GRATE BARS.

61 OLIVER ST., BOSTON. 109 LIBERTY ST., NEW YORK. 81 LAKE ST., CHICAGO.

SEND FOR NEW CATALOGUE.

Russell & Co.

MASSILLON, OHIO,

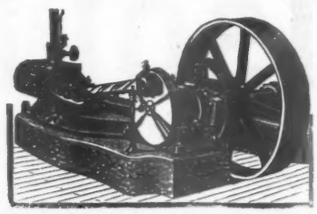
BUILDERS OF

AUTOMATIC ENGINES

BOILERS, ETC.

Complete Power Plants Furnished and Erected.

SEND FOR CATALOGUE.



The Billings & Spencer Co.

MANUFACTURERS of HARTFORD, CONN.

BILLINGS PATENT

PURE COPPER DROP FORGED COMMUTATOR BARS,

CARBON TONGS, FOR ELECTRIC MOTORS OR GENERATORS.

HAND VISES, EYE BOLTS,

WRENCHES, PLIERS,

COMMUTATOR RINGS & NUTS,

DROP FORGINGS OF BRONZE COPPER, IRON AND STEEL OF ALL DESCRIPTIONS.

CHARLES R. VINCENT & CO.,

15 CORTLANDT STREET, NEW YORK,

Ball High Speed Automatic Cut-off Engines

MANNING VERTICAL TUBULAR BOILERS,

Complete Steam Plants Furnished and Erected.

WM. H. COLE,

ELECTRICAL ENGINEER,

No. 775 TENTH AVE., NEW YORK CITY.

SPECIALTIES.—Electric Lighting, Electric Rail Roads, and power plants in connection with the same. Contractor for the construction of Electrical Machinery and Appliances. Independent, Reliable, Expert Measurements, Tests and Reports made.

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE —LEFFEL— WATER WHEEL.

SEND FOR CATALOGUE. 6

JAMES LEFFEL & CO.

SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

FISHER-RAE ELECTRIC RAILWAY SYSTEM,

FOR STREET AND SUBURBAN TRAFFIC.

Embraces new and valuable improvements which are requisite to economical operation and high efficiency.

THE ONLY SUCCESSFUL SYSTEM USING UNDERGROUND CONDUCTORS.

8 MILES OF CONDUIT IN ONE ROAD AT SAN JOSE, CAL.

OVERHEAD CONDUCTORS.

IMPROVED TROLLEY AND TROLLEY SUPPORT line of neatest design. Avoids "flashing" at wheel or line contact.

THE FISHER-RAE ELECTRIC RAILWAY SYSTEM

contains new features that will commend it to the careful attention of Street Railway Managers looking for reliable, easily operated and efficient electrical apparatus, designed to stand the test of work.

The FISHER-RAE SYSTEM

can be placed upon existing roads without alteration of track or road-bed, and upon cars in use without interruption to traffic of road.

POINTS OF SUPERIORITY.

A SINGLE MOTOR GEARED TO BOTH AXLES WITH IMPROVED NOISELESS GEAR.

FLEXIBILITY BETWEEN MOTOR AND CAR AXLES, INSURING CLOSE MESH AND PREVENTING BREAKING FROM SUDDEN STRAINS.

The use where desirable of a separate motor truck, making a six wheel car, securing greater comfort to passengers; motor trucks easily and quickly detachable, enabling change of motors from closed to open cars.

CORRESPONDENCE solicited, estimates furnished, and references given to important roads now in successful operation.

DETROIT ELECTRICAL WORKS,

7th and Woodbridge Streets, DETROIT, MICH.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE-MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE-MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the WASHINGTON CARBON CO.,

FACTORIES: WATERBURY, CONN.

J. L. BARCLAY, Selling Agent,
THE ROOKERY, CHICAGO, ILL.

NEW YORK OFFICE, 25 Park Place,
THOS. L. SCOVILL, NEW YORK AGENT.

PAILLARD NON-MAGNETIC WATCHES.

AVOID ALL IMITATIONS.

18 size full plate movement.

SEE THAT "Paillard's Patent" "Balance —AND— Spring" Is engraved on each movement

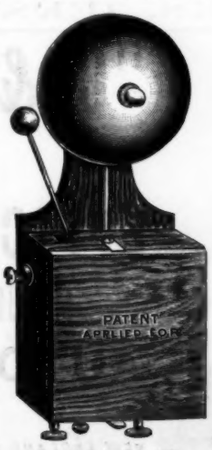
These Movements are of American Manufacture, and are the only American Movements made containing the Celebrated Paillard Inventions.

The Best American Non-Magnetic Watch.

BOOKS

ON ELECTRICAL SUBJECTS
Will be mailed to any address, postage prepaid, on receipt of price. Address,
ELECTRICAL REVIEW PUB. COMPANY,
13 Park Row, New York. P. O. Box, 3,329.

CENTENNIAL
WOOD BOX BELL.
Oak, Cherry, Mahogany, Walnut.



Patented April 9, 1889.

NEW HAVEN CLOCK CO.,

29 Murray Street, New York.

THIS BELL IS 1-3 SMALLER THAN ANY OTHER WOOD BOX BELL, ALL ADJUSTMENTS ON OUTSIDE OF CASE, MAIN BODY OF BELL MOUNTED TO WOODEN BACK BY HINGES. THIS BELL HAS BUT ONE MAGNET, RINGS CLEARER THAN MOST WOOD BOX BELLS, REQUIRES LESS BATTERY AND IS AN ORNAMENT TO ANY HOUSE.

Send for Sample.

Also for our Electrical Catalogue Illustrated in Colors.

W. D. SARGENT, President.
E. H. CUTLER, Treasurer and Manager.

JNO. A. BARRETT, Vice-President and Consulting Electrician.
FRANK A. PERRET, Electrician.

THE ELEKTRON MANUFACTURING COMPANY

COR. JAY & PLYMOUTH STREETS, BROOKLYN, N. Y.

OUR FAN OUTFITS ARE VERY HANDSOME AND RUN VERY STILL.

MANUFACTURERS OF

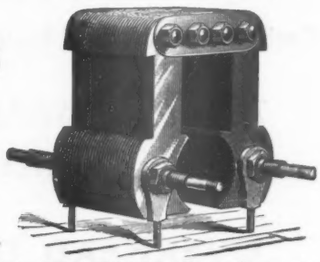
Perret Electric Motors AND Dynamos

SMALL SIZES A SPECIALTY.

1-8 TO 2 H. P.

THE DISTINCTIVE FEATURES ARE:

LAMINATED FIELD MAGNETS,
LOW ARMATURE RESISTANCE,
NO SPARKING UNDER CHANGES OF LOAD,
EXCELLENT WORKMANSHIP.



Laminated Field Magnets, by the use of which higher efficiency is obtained than is possible otherwise.

In Efficiency, Regulation, Simplicity and Durability our Machines Show Great Superiority.
Careful Investigation Invited. Catalogues Furnished on Application.

SPRAGUE ELECTRIC RAILWAY AND MOTOR CO.

The Sprague Improved Motor is Superior to any other machine which has ever been devised for the same work.

LIST OF STREET RAILWAYS IN OPERATION OR UNDER CONTRACT, MAY 9th, 1889.

Akron Electric R. R.	Akron, O.	Hartford & Wethersford R.R.	Hartford, Conn.	People's R. R.	Scranton, Pa.
Asheville Electric R. R.	Asheville, N. C.	Inclined Plane R. R.	Cincinnati, O.	Plattsmouth Electric R. R.	Plattsmouth, Neb.
Atlantic City Extension	Atlantic City, N. J.	Key City Electric R. R.	Dubuque, Ia.	Salt Lake City R. R.	Salt Lake City, Utah.
Bay City R. R.	Bay City, Mich.	Lafayette Electric R. R.	Lafayette, Ind.	Steubenville Electric R. R.	Steubenville, Pa.
Bay City Street Ry.	Bay City, Mich.	Lindell Avenue Street Ry.	St. Louis, Mo.	Stillwater Street R. R.	Stillwater, Minn.
Bay Ridge Electric R. R.	Bay Ridge, Md.	Lindell Avenue R. R.	St. Louis, Mo.	Tacoma Ave. Street R. R.	Tacoma, W. T.
Buffalo Street R. R.	Buffalo, N. Y.	Loop Extn., Wilkesbarre & Sub'n R. R.	Wilkesbarre, Pa.	Union Electric R. R.	Sterling, Ill.
Carbondale & Jermyn R. R.	Carbondale, Pa.	Main Street Line Extn. U. P. Ry.	St. Joseph, Mo.	Union Passenger R. R.	Richmond, Va.
Central R. R.	Davenport, Ia.	Manchester & Richmond R. R.	Manchester, Va.	Union Passenger R. R. Extn.	Richmond, Va.
Chattanooga Electric R. R.	Chattanooga, Tenn.	Marlborough Street R. R.	Marlborough, Mass.	Union Passenger R. R.	St. Joseph, Mo.
City Passenger R. R.	Erie, Pa.	Minneapolis Street R. R.	Minneapolis, Minn.	Washington St. & State Asylum R. R.	Binghamton, N. Y.
City R. R.	Wilmington, Del.	Naumkeag Street R. R.	Salem, Mass.	West End R. R.	Boston, Mass.
City R. R. Extension.	Wilmington, Del.	Northern Div., Wyatt Park Ry.	St. Joseph, Mo.	Wichita & Suburban R. R.	Wichita, Kansas.
Collamer Line.	East Cleveland, O.	Pacific Ave. Street R. R.	Tacoma, W. T.	Wilkesbarre & West Side R. R.	Wilkesbarre, Pa.
East Cleveland Street R. R.	Cleveland, O.	Passenger R. R.	East Harrisburg, Pa.	Wilkesbarre & West Side Ry.	Wilkesbarre, Pa.
East Reading R. R.	Reading, Pa.	Passenger R. R. Extn.	Harrisburg, Pa.	Wilkesbarre & Suburban R. R.	Wilkesbarre, Pa.
East Reading R. R. Ext'n.	Reading, Pa.	Penna. R. R. System	Atlantic City, N. J.	Williamette Bridge R. R.	Portland, Oregon.
East Side Street R. R.	Brocton, Mass.	Peoples R. R.	St. Joseph, Mo.	Wyatt Park R. R.	St. Joseph, Mo.
Eau Claire Street R. R.	Eau Claire, Wis.				

Each one of these names represents a separate bona fide Contract for Electrical Equipment.

FOR CIRCULARS AND FULL INFORMATION ADDRESS

16 & 18 BROAD STREEET, NEW YORK.

DAFT ELECTRIC LIGHT COMPANY,

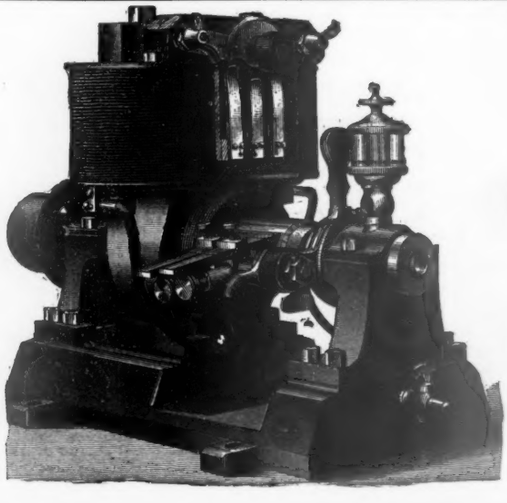
Executive Offices, 115 BROADWAY, New York.

Electric Railways and Power Stations,

STATIONARY MOTORS, STORAGE BATTERIES.

DYNAMOS, 1 to 250 H. P. MOTORS, ½ to 100 H. P.

WORKS, JERSEY CITY, N. J.



"C. & C." ELECTRIC MOTOR CO.

402 & 404 Greenwich St., New York.

EFFICIENT ELECTRIC MOTORS,

MANUFACTURED FOR ARC AND INCANDESCENT CIRCUITS.

AUTOMATICALLY REGULATED

NEW ENGLAND OFFICE, 32 OLIVER ST., BOSTON.
WESTERN OFFICE, 139 & 141 ADAMS ST., CHICAGO.
SOUTHERN OFFICE, 25 CARONDELET ST., NEW ORLEANS.
PHILADELPHIA OFFICE. 301 ARCH STREET.

M. T. Greene, President. Geo. A. McKinlock, Treasurer. Wm. H. McKinlock, Secretary.

Central Electric Company,

GENERAL WESTERN AGENTS OKONITE WIRE AND CABLES,

OKONITE TRADE MARK.

Candee Weatherproof Electric Light Line Wire

ABSOLUTELY THE BEST.

A COMPLETE STOCK OF GENERAL ELECTRIC SUPPLIES ALWAYS ON HAND. SHIPMENTS PROMPT.

CENTRAL ELECTRIC COMPANY, 42 LA SALLE STREET, CHICAGO, ILL.

COMPOUND. CONDENSING OR NON-CONDENSING.
16 Sizes, 5 to 500 H. P. Not yet equaled by any form of Engine for HIGH FUEL DUTY AND SIMPLICITY.

STANDARD. 13 Sizes in Stock. 5 to 250 H. P.
3,000 in use in all parts of the Civilized World.

JUNIOR. 6 Sizes in Stock, 5 to 50 H. P.
AN AUTOMATIC ENGINE CHEAPER THAN A SLIDE VALVE.
Well Built. Economical. Reliable. Over 300 sold the first year.

All the above built strictly to Gauge with Interchangeable Parts. Repairs Carried in Stock. Send for Illustrated Catalogues.

WESTINGHOUSE ENGINES

The Westinghouse Machine Co.
PITTSBURGH, PA. U.S.A.

SELLING DEPARTMENT IN THE UNITED STATES.

NEW YORK, BOSTON, PITTSBURGH, CHICAGO, PHILADELPHIA,	17 Cortlandt Street, Hathaway Building, Westinghouse Building, 156, 158 Lake Street, 608 Chestnut St.,	Westinghouse, Church, Kerr & Co. M. R. Muckle, Jr. & Co.
ST. LOUIS, KANSAS CITY,	302, 304 Washington Ave. 312 Union Avenue,	Fairbanks & Co.
DENVER, OMAHA,	1230 Seventeenth Street, 1619 Capitol Avenue,	F. C. Ayer.
PINE BLUFFS, Ark.		Geo. M. Dilley & Sons.
SALT LAKE CITY, BUTTE, MONT.	259 S. Main St. E. Granite St.	Utah & Montana Machinery Co.
SAN FRANCISCO, PORTLAND, OR.	21 and 23 Fremont St., 33, 35 N. Front St.,	Parke & Lacy Co. Parke & Lacy Mch. Co.
CHARLOTTE, N. C. ATLANTA, GA.	36 College St., 45 S. Prior St.	The D. A. Tompkins Co.
DALLAS, TEX. CHATTANOOGA, TENN.		Keating Imp. & Mch Co. C. E. James & Co.

HEADQUARTERS
— IN —
NEW YORK CITY
— FOR —
STANDARD MILLING MACHINES.

UNIVERSAL, LIGHT, OR PLAIN FOR HEAVY WORK.

ALL SIZES READY FOR QUICK DELIVERY.

MACHINES SHOWN IN OPERATION

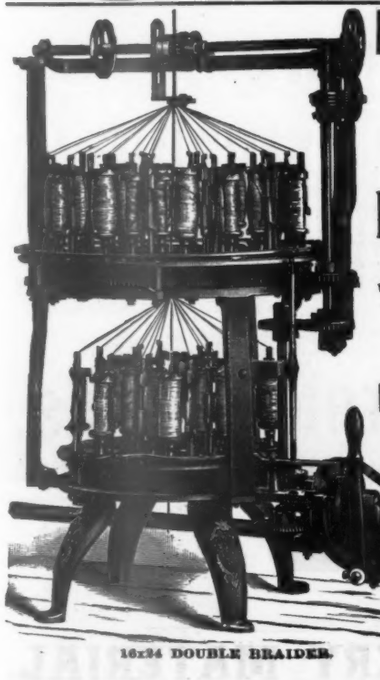
BY THE MANUFACTURERS,

E. E. Garvin & Co.,
139, 141 & 143 CENTRE STREET, NEW YORK CITY.
SEND FOR ILLUSTRATED CATALOGUE.

SUNLIGHT CARBONS

The PARKER-RUSSELL MINING & M'F'G CO.
ROOMS, 200 and 202
AMERICAN CENTRAL BUILDING,
ST. LOUIS.

UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT.



16x24 DOUBLE BRAIDER.

NEW ENGLAND BUTT CO.,
Providence, R. I.,
MANUFACTURERS OF
Braiding Machinery
FOR COVERING
TELEGRAPH, TELEPHONE AND ELECTRIC-LIGHT WIRE
ALSO
SINGLE AND DOUBLE
WINDERS AND BRAIDERS
Of every Description for Silk, Worsted and Cotton Braid.

FINE CASTINGS A SPECIALTY

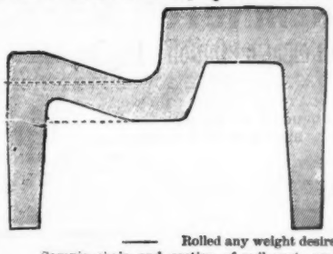
WILLIAMS & POTTER,
15 CORTLANDT ST., NEW YORK.
Engineers & Contractors,
GENERAL AGENTS,
STRAIGHT LINE ENGINES

VAN DEPOELE ELECTRIC MF'G CO.

MANUFACTURERS OF ARC & INCANDESCENT ELECTRIC LIGHT APPARATUS & SUPPLIES OF ALL KINDS

OFFICE & WORKS
15, 17, 19 & 21 NORTH CLINTON ST.
CHICAGO.

R. T. WHITE,
12 Pearl St., (Room 6), BOSTON, MASS.



IMPROVED
PATENTED MATERIAL FOR STREET RAILWAY ROADBEDS.

BEST MATERIAL, LOWEST PRICES,
CORRESPONDENCE SOLICITED.

Rolled any weight desired. Patent allowed.
Sample chair and section of rail sent, express prepaid, to prospective purchasers.

THE E. S. GREELEY & CO.,

Nos. 5 & 7 Dey St., New York
Manufacturers and Importers of and Dealers in
Telegraph, Telephone — AND — Electric Light Supplies
AGENTS FOR
Cleveland Arc Light Cut Outs & Gang Switches
Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.
Rubber, Porcelain and Glass Insulators
WIRES OF ALL KINDS.
Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.
Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

BELL HANGERS' HAND BOOK

BY F. B. BADT.

106 Pages, 97 Illustrations, Flexible Cloth Binding, Type Pages 5½ x 3 inches.

PRICE ONE DOLLAR.

Just the Book for those engaged in Selling, Installing or Handling Electric Batteries, Electric Bells, Elevator, House or Hotel Annunciators, Burglar or Fire Alarm, Electric Gas Lighting Apparatus, Electric Heat Regulating Apparatus, Etc.. Etc.

THE ONLY BOOK OF THE KIND PUBLISHED.

FIRST EDITION TWENTY-FIVE HUNDRED COPIES. SENT, POSTAGE FREE, ON RECEIPT OF PRICE.

Western Electric Company, 227 South Clinton Street, Chicago.

AND 70 TRINITY PLACE, NEW YORK.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel. **WASHINGTON, D. C.**

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.
Eastern Agents, C. R. Vincent & Co., Room 16 15 Cortlandt Street, New York.

THE STREET RAILWAY JOURNAL

Vol. V. 113 Liberty St., New York. Monthly, $3.00 Per Year.

THE STREET RAILWAY JOURNAL, 113 Liberty Street, NEW YORK.

CONTENTS.
Each issue contains 120 pages or more, including 30 pages of reading matter and illustrations
A Directory of Street Railways in the United States and Canada.
A Directory of Manufacturers of street railway appliances and materials.

Is the Best Advertising Medium through which to reach Street Railways.

Ball Electric Light Co.
18 CORTLANDT ST.
NEW YORK

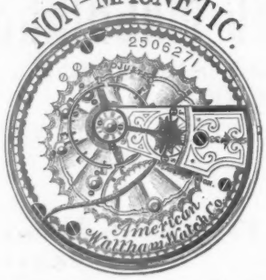
MANUFACTURERS
The Celebrated BALL DYNAMOS and LAMPS
— FOR —
ARC AND INCANDESCENT LIGHTING.

This System is **mechanically** and **electrically** perfect and produces a steady, white and noiseless light with the minimum of expense, both as to the power required and the cost of repairs.

For descriptive Circulars or Testimonials, address

FACTORY: 9th Ave. & 27th St., New York City.
BALL ELECTRIC LIGHT CO., 18 Cortlandt St., N. Y. City.

WALTHAM



WATCHES
are the best for electricians, railroad men, engineers and others whose vocation requires a watch that is both absolutely non-magnetic and an accurate timekeeper.

Manufactured and Warranted by the
AMERICAN WALTHAM WATCH CO.
WALTHAM, MASS.

THE NATIONAL GALVANIC BATTERY

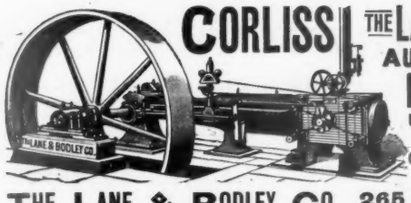
UNEQUALED FOR
BELLS, TELEPHONES, GAS LIGHTING, ETC.
PLATINUM CARBON CONNECTION.
PERFORATED BODY.
The only real improvement of a **POROUS CUP.**
NO SOAKING REQUIRED.
ALWAYS WORKS INSTANTLY,
WILL LAST A LIFE TIME.
SIMPLE, CLEAN, DURABLE.
Write for circulars & prices.

THE NATIONAL GALVANIC BATTERY CO.
241 Main St, CINCINNATI, O
18 Cortlandt St., NEW YORK.

J. E. JEFFORDS & CO.,
Manufacturers to the Trade.
POROUS CELLS
Of Every Description, Made to Order.
25 years' experience in this branch of the business.
2716 to 2738 Salmon St., Philadelphia, Pa.

ARMINGTON & SIMS ENGINE COMPANY
TRADE MARK
PROVIDENCE, R.I. U.S.A.

THE ARMINGTON & SIMS
Automatic Cut-off Engine,
FOR ALL PURPOSES WHERE POWER IS REQUIRED.
CLOSE REGULATION,
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE,
OVER 2,500 ENGINES IN USE.
— SEND FOR CIRCULAR. —



CORLISS THE LANE & BODLEY CO.
AUTOMATIC CUT OFF
ENGINES
Unrivalled for Strength, Durability and Close Regulation.
CONSTRUCTION OF COMPLETE PLANTS A SPECIALTY.
THE LANE & BODLEY CO., 265 to 271 WATER ST., CINCINNATI, O.

FRANKLIN S. CARTER CHAS. M. WILKINS. E. WARD WILKINS.
ESTABLISHED 1867.
PARTRICK & CARTER,
MANUFACTURERS OF AND DEALERS IN EVERY DESCRIPTION OF
ELECTRICAL SUPPLIES.
SOLE PROPRIETORS OF THE
PATENT NEEDLE ANNUNCIATORS AND BURGLAR ALARMS.
WE MAKE A SPECIALTY OF
BELLS, DISQUE LECLANCHE BATTERIES, GAS-LIGHTING APPARATUS
AND A FULL LINE OF
SUPPLIES FOR ELECTRIC BELL WORK.
We publish Catalogues of all our Manufactures, and will forward to any address upon application.
N. B.—When applying for Catalogues please state whether "Electric Bell" or "General only" Catalogues are wanted, and if in the trade indicate whether you are entitled to discounts.
114 South Second Street. PHILADELPHIA, PA.

THE NATIONAL CARBON CO.
CLEVELAND, OHIO.
MANUFACTURERS OF
ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

THE EDDY ELECTRIC M'F'G CO.

MANUFACTURERS OF

AUTOMATIC ELECTRIC MOTORS,

In all sizes, from 1-2 H. P. upward; High Efficiency; Perfect Regulation; Superior Workmanship; Ease of Management; Remarkable Simplicity, etc., etc.

DYNAMO ELECTRIC MACHINES,

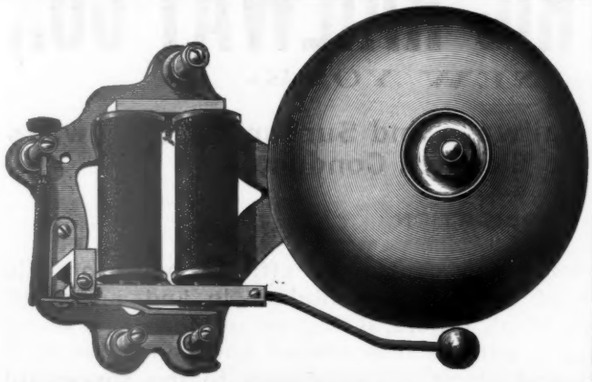
For Electro-Plating, Electrotyping, Copper Refining, Etc. No Reversing. No Water. No Noise. No Spark.

SATISFACTION GUARANTEED.

THE EDDY ELECTRIC M'F'G CO., WINDSOR, CONN.

NEW YORK, 115 Broadway, BOSTON, 620 Atlantic Ave., PHILADELPHIA, 506 Commerce Street.

Manufacturers



H. E. & C. BAXTER, 18 Fulton Street, Brooklyn, E. D.

All genuine ingots & manufactures bear our REG. TRADE MARKS "Phosphor-Bronze"

PHOSPHOR-BRONZE

INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

THE "MONUMENTAL" MAGNETO BELL.

For use with Acoustic Telephones and for general signal purposes. Works well on lines up to three or four miles in length.

Send for Descriptive Circular With Prices.

Magneto and Extension Bells, Hand and Power Generators of all Sizes.

Electrical Supplies of ALL KINDS manufactured and sold at the lowest prices.

VIADUCT MANUFACTURING CO., BALTIMORE, MD.

STORED ENERGY.

ELECTRICAL ACCUMULATORS

Central Station Lighting, Isolated Lighting,

Railroad Car Lighting, Long Distance Lighting.

ESPECIALLY ADAPTED TO

STREET CAR PROPULSION

AND

For operating Central Station and Isolated Plants during periods of LIGHT LOAD, enabling steam plant to shut down.

Can be used with any Direct System for completely displacing gas.

The ONLY Company owning and supplying complete automatic Regulating Apparatus for use with Accumulators.

WRITE TO

The Electrical Accumulator Co.,

44 Broadway, New York,

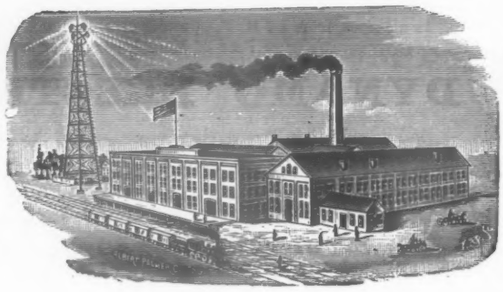
Stating system used, capacity of plant, power available and other requirements.

Chicago Office, Phenix Building. Detroit Office, 30 Atwater St., East.

Fort Wayne Jenney Electric Light Company,

FORT WAYNE, IND.

The most carefully worked out and Complete Alternating System of Electric Lighting in existence. Armatures and Converters guaranteed. 12-16 candle-power Lamps to the mechanical horse power guaranteed.



MANUFACTURERS OF THE

SLATTERY INDUCTION SYSTEM

OF

Incandescent Lighting

AND THE

Original Jenney System

OF

ARC LIGHTING.

SLATTERY DYNAMO, LAMP AND CONVERTER.

CORRESPONDENCE SOLICITED.

JENNEY DYNAMO AND LAMPS.

MAIN OFFICE AND WORKS, FORT WAYNE, IND.

New York Office, Room 45, 115 Broadway.

Manhattan Electric Light Co., 511 Broadway, Sole Licensees and Agents for New York City and Brooklyn.

CHICAGO OFFICE, 185 Dearborn St., *W. J. BUCKLEY, Manager.*

PHILADELPHIA OFFICE, 907 Filbert St., *G. A. WILBUR, Manager.*

SAN FRANCISCO OFFICE, 217 Sansome St.

F. ADAM SUC'S, CITY OF MEXICO.

BENTLEY-KNIGHT ELECTRIC RAILWAY CO.,

25 & 27 TENTH AVE., NEW YORK.

Contractors for the Construction of City Street Railways and Surburban Tramways using either Underground, Surface or Elevated Conductors.

ESTIMATES FURNISHED ON APPLICATION.

N. B.—The Bentley-Knight Electric Railway Company absolutely controls all efficient and economic methods of operating electrically-equipped cars by means of conductors contained in and protected by sub-surface conduits. Entering the field long in advance of all others, it first encountered the many difficulties which had to be met and overcome; and the many patents now owned and controlled by it effectually cover each and every detail (both mechanical and electrical) necessary to the successful construction and operation of an electrical railway in a city street.

ELECTRICAL CONTRACT WORK.

Detailed Estimates made and Contracts taken for

EQUIPMENT OF COMPLETE

Steam and Electrical Plants

— OF —

ANY SYSTEM

— OF —

ARC AND INCANDESCENT LIGHTING,

CENTRAL STATIONS,

And ELECTRIC STREET RAILWAYS, operated overhead, underground or by storage batteries.

Address,

EUGENE T. LYNCH, Jr., Consulting Engineer,
120 BROADWAY, NEW YORK.

THE P. & B. PAINT

IS ESSENTIAL FOR

LEAD COVERED CABLE FOR *UNDERGROUND USE.*

The New York Times in a recent issue, states that the Expert of the Board of Electrical Control, reports to Mayor Grant that the Wires in the Subways operated by the United States Illuminating Company and the Manhattan Electric Light Company work perfectly, and same are steadily improving in insulation.

EVERY FOOT OF THESE CABLES ARE COATED WITH THE P. & B. PAINT.

Cables coated with the P. & B. have been in operation underground for more than two years and are in every instance to-day in perfect condition. Other cables not so treated, many of them in the same Conduit systems, have long since given out.

SEE THAT YOUR CABLES ARE COATED WITH P. & B.

THE STANDARD PAINT CO., 59 Maiden Lane, N. Y.